TWELFTH ANNUAL REPORT

OF THE

AMERICAN

DAIRYMEN'S ASSOCIATION,

WITH

TRANSACTIONS AND ADDRESSES,

FOR THE YEAR 1876.

INGERSOLL, ONT.:
PRINTED AT THE CHRONICLE STEAM BOOK AND JOB OFFICE, THAMES STREET.
1877.

INDEX

OF THE

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AMERICAN

DAIRYMEN'S ASSOCIATION.

PREFARATORY REMARKS.

Since the publication of the Eleventh Annual Report, two Conventions have been held by the American Dairymen's Association—one on the Centennial grounds at Philadelphia, the other at Ingersoll, Canada.

The Philadelphia Convention was appointed by invitation of the Philadelphia Produce Exchange, to meet in the rooms of the Exchange, but for the greater convenience of persons visiting the International Exhibition, the place was changed to Judge's Hall, on the Centennial grounds. It opened on the 17th of October, and held one session a day for four days. It was made an international meeting and was open to the people of all countries, who might desire to attend. The addresses which were prepared by citizens of the United States, Canada, and England, will be found able and instructive papers. From not obtaining some of the addresses until after the Report went to press, the proceedings of the Convention, first in order of time, had to be placed in the latter part of the Report.

The active part taken in the Association at its formation and during its earlier history, by the Dairymen of Canada, led its founders and early supporters to embrace the Dominion in the field of its labors, and the name given to the organization was made to accord with this fact, though the Conventions continued to be held in the States. In view of these facts and of the efficient aid rendered by Canadian Dairymen in sustaining the late International Dairy Exhibition, through the liberality of funds contributed, their vigorous exertions, and the high character as well as the extent of their exhibits, and in view of the further fact that the Associatian had already held meetings on four days in the United States, the Executive Board deemed it appropriate to accept the invitation of the Ingersoll Board of Trade to hold the annual meeting of the current year at Ingersoll, the great centre of the cheese producing district of Canada, and it was accordingly so held.

This brief Statement of the reasons for holding the late meeting on the north side of the St. Lawrence, is deemed proper by the Secretary, as some people in the States have, not fully appreciating all the circumstances, thought strangely of moving the Annual Convention from the neighborhood of its accustomed location.

The meeting proved a large and profitable one. The only unfavorable circumstance connected with it was the occurrence of an unprecedented snow storm along the line of the N. Y. Central Rail Road, which prevented the attendance of some two hundred people from the States, who otherwise would have been present to participate in its proceedings. But notwithstanding the storm the Hall was well filled from the Canadian side, and the papers and discussions sustained the high character of the previous meetings of the Association, as a perusal of them will fully show, and they are accordingly submitted with much satisfaction, to the Dairymen both of Canada and the States.

L. B. ARNOLD, SECRETARY.

ROCHESTER, May, 1877.

ARTICLES OF ASSOCIATION.

WHEREAS, It is deemed expedient to merge the New York State Cheese Manufacturers' Association, which was organized in January, 1864, into an American Association, through which, as a medium, results of the practical experience of dairymen may be gathered and disseminated to the dairying community ; therefore,

Resolved, That we, the undersigned, do hereby associate ourselves together for mutual improvement in the science of cheese-making, and more efficient action in promoting the general interest of the dairy community.

ARTICLE I. The name of the organization shall be The American Dairymen's Association.

ART. II. The Officers of the Association shall consist of a President, Vice-President, Secretary and Treasurer.

ART. III. The President, Vice-Presidents, Secretary and Treasurer, shall constitute the Executive Board of the Association.

ART. IV. The Officers of the Association shall be elected at the regular annual meeting, and shall retain their offices until their successors are chosen.

ART. V. The regular annual meeting shall occur on the second Tuesday in January of each year, and at such place as the Executive Board shall designate.

ART. VI. The payment of one dollar shall admit any person to all the sessions of an Annual Meeting—and the additional payment of seventy-five cents shall entitle him to the Annual Report for the current year.

AMENDMENT.—The Secretary is hereby empowered to appoint an Assistant Secretary to assist during the sittings of the Convention, and discharge such other duties as may be assigned to him, and, in case of the absence or inability of the Secretary to act, to temporarily discharge the duties of that office ; it being distinctly understood that no compensation is attached thereon.

[One dollar constitutes a person not attending an Annual Convention a member of the Society for one year, and entitles him to the Annual Report.]

OFFICERS OF THE ASSOCIATION

FOR 1877.

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Hon. HORATIO SEYMOUR, Utica, N. Y.

VICE PRESIDENTS : .

C. E. CHADWICK, Ingersoll, Ont.
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O. S. BLISS, Vermont.
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STEPHEN FAVILLE, Wisconsin.
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G. B. WEEKS, Onondaga.
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THOMAS BALLANTYNE, M. P. P., Stratford, Ont.
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MADISON COOPER, Evans Mills, N. Y.
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Hon. Wm. A. JOHNSON, Collins Centre, N. Y.
Dr. L. L. WIGHT, Whitesboro, N. Y.
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DAVID H. BURRILL, Herkimer.
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SECRETARY :

L. B. ARNOLD, Rochester, New York.

TREASURER :

Hon. HARRIS LEWIS, Frankfort, Herkimer County, N. Y.

LIST OF MEMBERS

OF

THE AMERICAN DAIRYMEN'S ASSOCIATION,

FOR THE YEAR 1877.

Anderson, Wm., Woodstock, Oxford.
Anderson, W. H., Ingersoll, Oxford.
Andrew, Philip, Avon, Oxford.
Agur, Wm. Jr., Thorndale, Oxford.
Ashley, H., Belleville, Hastings.
Arthur, Wm. Ingersoll, Oxford.
Agur, Wm., Verschoyle, Oxford.
Atwood, W., Salford, Oxford.
Arthur, Jno., Kintore, Oxford.
Adams, Jno., Ingersoll, Oxford.
Agur, Robt., Ingersoll, Ont.
Adkins, Jno., Putman, Oxford,
Abraham, Jno., Otterville, Oxford.
Allan, Sam., Embro, Oxford.
Anstice, F. C., Springford, Oxford.
Allison, J no., Brownsville, Oxford.
Arnold, L. B., Rochester, N. Y.
Abbot, E.' Camden, Oneida Co., N. Y.
Andrews, J. P., Attiea, Wyoming Co., N. Y.
Armstrong, A. B., Dorset, Vt.
Adams, James C., Springfield Centre, Otsego Co., N. Y.
Ayers, E. A., Watertown, N. Y.

Butchard, Jas. M., West Flamboro.
Ballantyne, Thos., M.P.P., Stratford, Perth.
Bolger, S. C., Stratford, Perth.
Bobier, Joshua, Ingersoll, Oxford.
Bennett, G. H., Chatham, Essex.
Butterfield, D. S., Norwich, Oxford.
Beaton, Wm. L., Norwich, Oxford.
Bungay, L. F., Norwich, Oxford.
Bowman, Noah S., Haysville, Oxford.
Bailey, Jas., Ingersoll, Oxford.
Butler, Jno., Mt. Elgin, Oxford.
Brett, Wm., St. Marys, Perth.
Bell, A., Innerkip, Oxford.
Burdick, S., Dorchester, Middlesex.
Berry, Thos., Culloden, Oxford.
Baldwin, O. K., Vienna, Elgin.
Brady, Jas., Ingersoll, Oxford.
Barraclough, T., Ingersoll, Oxford.
Banbury, Chas., Mt. Elgin, Oxford.
Brown, T., Ingersoll, Oxford.
Bates, Ezra, Norwich, Oxford.
Bates, Horatio, Norwich, Oxford.
Birrell, D., Little Falls, N. Y.
Bailey, Geo., Ingersoll, Oxford.
Bate, C., Toronto, City.
Bodwell, A., Mt. Elgin.
Bell, Prof. James T., Belleville.
Blanding, Wm., Hawleytown, Broome Co., N.Y.
Bonfoy, Geo. A., West Winfield, Herkimer Co., N. Y.
Bonfoy, Seth, West Winfield, Herkimer Co., N. Y.
Blanding, F., Brookfield, Madison Co., N. Y.
Brooks, M. C., Bowen's Corners, Oswego Co., N. Y.
Beech, E. C., Fish Creek Station.
Broadbent, Frank, Troy, 86 North M. street, N. Y.
Bradley, E. F,. 35 Elizabeth, street, Utica, N.Y.
Browne, O. L. F., Syracuse, N. Y.
Baker, J. C., Corry, Erie Co., Penna.
Burleigh, J. F., Verona, Oneida Co., N. Y.
Burgess, A. F., Erieville, Madison Co , N. Y.
Bussy, A. P., Westernville, Oneida Co., N. Y.
Briggs, C. W., Sennet, N. Y.
Briggs, David, Durhamville, Oneida Co., N. Y.
Bleuis, J. W. Salisbury Centre. Herk. Co., N.Y.
Bartlet, J. W., Ava, Oneida Co., N. Y.
Baird, J., Van Hornesville, Herkimer, Co., N. Y.
Ball, S., Unadilla Forks, Otsego Co., N. Y.
Bliss, O. S., Georgia, Vt.
Bigger, J. M., Cambridgeboro, Pa.
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Blanchard, Flint, Jamestown, Chautauqua Co.
Brown, James P., Utica, N. Y.

Clark, Wm., Avonbank, Perth.
Clark, Jacob, Thamesford, Oxford.
Cornell, J. H., Washington, Oxford.
Cornell, Harvey, Washington, Oxford.
Craik, Jas., Putnam, Oxford.
Coulton, Abel, Stratford, Perth.
Casswell, Joshua G., Dounfield, Cains-cross roads, Stroud, Gloucestershire, England.
Connelly, B., Ingersoll, Oxford.
Cohoe, J. W., New Durham, Oxford.
Cole, Geo., Sarnia, Lambton.
Collins, Orlando, Mt. Elgin, Oxford.
Christie, J. R., Culloden, Oxford.
Caddy, T., Ingersoll, Oxford.
Cowan, Wm., Innerkip, Oxford.
Colhoun, Sam., Harrietsville, Oxford.
Clark, Orange, Ingersoll, Oxford,
Clark, J. S., Wyoming.
Clyne, Jno., Avonbank, Perth.
Casey, A. W., Mitchell, Perth.
Clark, Jas., East Nissouri, Oxford.
Chadwick, L. J., Ingersoll, Oxford.
Curtis, A., Ingersoll, Oxford.
Coyne, I., Ingersoll, Oxford.
Caldwell, O. B., Ingersoll, Oxford.
Clalmers, D., Honey Grove, Perth.
Clements, Joel, Preston, Waterloo.
Cranston, R. R., Cranston, Brant.
Chisholm, W., Mayfair, Kent.
Cohoe, D. B., Burgessville, Oxford.
Chadwick, Chas. E., Ingersoll, Oxford.
Casswell, E., Ingersoll, Oxford.
Cook, G. H., Beachville, Oxford.

Clark, H. T., Vernon, Oneida Co., N. Y.
Cheesebro, Dennison S., Geddes, Onondaga Co., N. Y.
Cory, Norman, Taburg, Oneida Co., N. Y.
Cady, O., Freeville, Tompkins Co., N. Y,
Clark, J. H., South Albion, Oswego Co., N. Y.
Converse, Edward, Sterlingville, Jefferson Co., N. Y.
Custis, F. H., Brier Hill, St. Lawrence Co., N.Y.
Crill, Geo. W., North Western, Oneida Co., N.Y.

Carroll, John, Salisbury, Herkimer Co., N. Y.
Creaser, W. L., Hecla Works, Oneida Co., N.Y.
Chandler, A., Berne, N. Y.
Chapman, L. P., Randolph, Wis.
Cahoe, J. G., Fredonia, N. Y.
Caldwell, Prof. G. C., Ithaca, N. Y.
Curtis, T. D., Syracuse, N. Y.
Cooper, Madison, Evans Mills, Jefferson Co., N. Y.
Craft, Dr. E. G., Binghamton, N. Y.
Crocker, Col. O. C., Binghamton, N. Y.
Cole, Dr. G. F., Canton, St. Lawrence Co., N.Y.
Curtis, D. W., Fort Atkinson, Wis.
Chapman, John R., Oneida Lake, N. Y.
Condimental Food Co., 208 N. Front Street, Philadelphia, Pa.

Dundass, D. J., Beachville, Oxford.
Duncan, Gilbert, Norwich, Oxford.
Dunn, Peter, Ingersoll, Oxford.
Dunn, Wm., Ingersoll, Oxford.
Dunn, Jno., Harrietsville, Oxford.
Dunn, J. P., Mossley, Oxford.
Dunn, Larey, Ingersoll, Oxford.
Downing, Frank, Brownsville, Oxford.
Drummond, Robt., Brownsville, Oxford.
Downham, P., Bryanston.
Deo, Chas., Aylmer, Ont.
De Long, G. V., Jr., Woodstock, Oxford.
Daly, A., Ingersoll, Oxford.
Dodge, Jno., Beachville, Oxford.
Dunn, Andrew, Ingersoll, Oxford.
Dempsey, T., Co. Perth, Fairview.
Dundass, Wm. Ingersoll, Oxford.
Dennis, J. 2d, Berne, N. Y.
Davison, J. W, Frankfort, Herkimer Co., N. Y.

Elliott, Jas., Brownsville, Oxford.
Ellis, Wm. A., Culloden, do
Evans, Jno., Jr., Glandstone, Oxford.
Elliott, I. W., Culloden, do
Elliott, Sam., Ingersoll, do
Ellis, R. Y. Ellis, do do
Ellis, W. E., Hespeler, do
Elliott, Jas., Mt. Elgin, do
Ehle, M. P., Edwardsville, St Lawrence Co., N. Y.
Ellison, Jacob, Middleville, Herkimer Co., N.Y.
Edwards, J. J., Canajoharie, Montgomery Co., N. Y.
Eaton, Aaron, Hannibal, N. Y.
Ellsworth, John T., Barre, Mass.

Farrington, J. L., Norwich, Oxford.
Farrington, Harvey, do do
Facey, Robt., Harrietsville, do
Fierheller, Cynes, Ingersoll, do
Frezelle, Robt., do do
Fawkes, T. F., do do
Farrington, Geo., Bright, do
Fearman, F. W., Hamilton, Wellington.
Freeman, H. O., Sherburne Chenango Co, N.Y.
Fairchild, E. B., Fairfield, Herkimer, Co., N.Y.
Folsom, M., 70 Warren Street, New York City.
Franklin, F., Hammond, St. Lawrence Co., N.Y
Fox, Geo. A., Loraine, Jefferson Co., N. Y.
Fogarty, Jerry, Springfield Centre, Otsego Co., N. Y.
Fuller, J. E., Floyd, N. Y.
Fuller, A. M. Meadville, Pa.
Faville, Stephen, Lake Mills, Wis.
Farrington, S. A., Cambridgeboro, Pa.

Galliver, Jno., Fingal, Elgin.
Galloway, Geo., Ingersoll, Oxford.
Grant, Geo., Embro, do
Griffin, Geo., Burgessville, do
Griffith, A., Thorndale, do
Gurnett, G. F., Ingersoll, do
Galloway, Jno. C., do do
Grant, Jas. M., do do
Galer, J. C. B., do do

Griffith, J. E., Byron, Ingersoll, Oxford.
Greaves, Thos., Seabringville, Perth.
Gillard, W., Tavistock, Oxford.
Galliver, H., Fingal, Essex.
Grierson, J. H., Herkimer, Herkimer Co., N.Y.
Gates, Wm. M., Whitesboro, Oneida Co., N.Y.
Golden, R., Little Falls, Herkimer Co., N. Y.
Guller, J. M., Edwardsville, St. Lawrence Co., N. Y.
Guller, James, Oswegatchie, N. Y.
Gray, Alex., Rome, N. Y.
Grifford, C. O., Eayetteville, Onondaga Co., N. Y.
Greggorans, William, Lee, N. Y.
Gardiner, Capt., H. D., McLean, Tompkins Co., N. Y.
Gold, T. S., West Cornwall, Conn.
Green, H. Cooley, Meadville, Pa.
Guller, Gilbert, Forestel, St. Charles Co., Mo.
Gleason, Hon. G. M., Governeur, N. Y.
Gillett, Harris, Sidney Plains, Jefferson Co., N. Y.

Herrich, A. J., Springford, Oxford.
Hamilton, Geo., Cromarty, Perth.
Hunter, Ed., Ingersoll Oxford.
Hopkins, Benj., Brownsville, Oxford.
Harrington, Jacob, Woodstock, do
House, R. H. Bookton, do
Herriott, Wm., Mt. Elgin, do
Howell, Hamilton, Iona, Elgin.
Hays, Thos., Seaforth, Perth.
Hettle & Ingles, Teeswater, Perth.
Holmwood, W., London, Middlesex.
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Harland, A., Highgate, Kent.
Heatley, W. H., Brantford, Brant.
Hopkins, E. N., Tilsonburg, Oxford.
Hearn, H., Ingersoll, do
Holcroft, W., do do
Harris, Jas., do do
Harris, Wm., Mt. Elgin, do
Henderson, Jno., Thamesford, do
Henderson, J. S., Ingersoll, do
Huxley, Wm., Fullarton, Perth.
Hegler, J. C., Ingersoll, Oxford.
Humphreys, Robert, Jr., Prospect, Oneida Co., N. Y.
Huffman, H. C., Horseheads, Chemung Co., N. Y.
Huntingdon, Edward, Rome, N.Y.
Hannum, H. A., Cazenovia, Madison Co., N. Y.
Harris, Thomas E., West Winfield, Herkimer Co., N. Y.
Hutchinson, Geo. W., Port Byron, Cayuga Co., N. Y.
Higgins, John, Speedsville, Tompkins Co., N.Y.
Hughes, Stone Mills, Jefferson Co., N. Y.
Hays, D. A., Cedarville, Herkimer Co., N. Y.
Holmes, C. H., West Winfield, Herkimer Co., N. Y.
Hunt, Olin, Lairdsville, N. Y.
Harris, B. J., Antwerp, Jefferson Co., N. Y.
Hubbell, J. G., Groton, Tompkins Co., N. Y.
Hawkins, H. T., Fort Plain, Montgomery Co., N.Y.
Hollis, D. D, Woodville, Jefferson Co., N. Y.
Hill, C. A., Oneida Castle, N. Y.
Hawley, L. T., Syracuse, N. Y.
Hayward, M., Weston, Mich.
House, Charles, Houseville, Lewis Co., N. Y.
Hazen, Chester, Ladoga, Wis.
Hawkins, Edward, Stanwix, Oneida Co., N. Y.
Hills, Edgar, Vernon, Oneida Co., N. Y.

Inman, Sam., Avonton, Perth.
Ingersoll, F. D., Albion, Orleans Co., N. Y.
Ingham, A. W., Adams, N. Y.

Joliffe, H., Avon, Perth.
Joliffe, D., Thamesford, Oxford.
Jarvis, Jonathan, Ingersoll, do

Jardine, J. W., Hamilton, Wellington.
Johnson, W. C., Ingersoll, Oxford.
James, Jas. A., Nilestown, do
Johnson, Hon. Wm. A., Collins Centre, Erie Co., N. Y.
Johnson, A., Lee Centre, Oneida Co., N. Y.
Jones, Jonathan, Utica, N. Y.
Jordan, Henry, Burke, Franklin Co., N. Y.
James, Chas. A., North Gage, Oneida Co., N. Y.
Jemison, Lewis, Binghamton, N. Y.
Jenkins, W. A., Streetsboro, Ohio.
Judson R. E., Farmington, Minn.

Kirkley, P., Newark, Oxford.
Keachie, Jas., Sheffield.
King, W. S., Ingersoll, Oxford.
Kerr, T., Eagle, Kent.
Kemp, D., Ingersoll, Oxford.
Kinyon, B. Benj., Rome, N. Y.
Keeler, G. W., Malone, Franklin Co., N. Y.
Kinsbury, Eugene H., Lee, N. Y.

Lawson, Jas., Peebles, Oxford.
Lewis, J. B., Sandusky, Cataragus Co., N. Y.
Lossee, Jno., Burgessville, Oxford.
Laur, J. C., Avon, Perth.
Lampman, Arch., Woodstock, Oxford.
Lowes, J. H., Ingersoll, Oxford.
Lewis, N., do do
Logee, S. P., do do
Lewis, Erwin, do do
Lambert, C. B., Dealtown, Elgin.
Little, R., Hespeler, Elgin.
Lossee, H. S., Norwich, Oxford.
Lane, J. B., Dorchester, do
Laidlaw, L. L., P. O. Box 512, New York City.
Loucks. Geo. W., Potsdam, St. Lawrence Co., N. Y.
Lazenbe, W. R., Ithaca, N. Y.
Littlewood, G. H., New Berlin, Chenango Co., N. Y.
Lockart, W. G., Oneida, Madison Co., N. Y.
Lynk, A. M., Westmoreland, Oneida Co., N.Y.
Locke, W. P., Waterville, N. Y.
Laird, P. D., Woodville, Jefferson Co., N. Y.
Lindsley, L. S., Pratt's Hollow, Madison Co., N. Y.
Lewis, Hon. Harris, Frankfort, Herkimer Co., N. Y.
Lewis, J., Fredonia, Chautauqua Co., N. Y.
Lewis, David W., New York City.
Larama, Fred., Fort Plain, Montgomery Co., N. Y.
Lewis, J. B., Sandusky, Cattaraugus Co., N.Y.

Moore, A. B., Otterville, Oxford.
Moore, W. D., Eastwood, do
Monck, Lorenzo, Mt. Elgin, do
Matheson, Hugh, Embro, do
Marr, Geo., Ingersoll, do
Martin, Thos., Beachville, do
Maughan, Geo., Ingersoll, do
Marshall, Jno., Putnam, do
Morton, D., Ratho, do
Minkler, A., Ingersoll, do
Minkler, M., do do
Mulkin, Jas., St. George.
Mott, E. E., Burgessville, do
Master, J. H., Strathallan, do
Murrry, D. R., Bemington, Perth.
Mott, T. C., Edward, St. Lawrence Co., N. Y.

Moore, F. W., Erieville, Madison Co., N. Y.
Mather, Luther P., Nelson, Madison Co., N. Y.
Miller, Levi G., Bear Hill, St. Lawrence Co.
Meigs, J. H., Verona, Oneida Co., N. Y.
Martyn, A. T., Canton, St. Lawrence Co., N.Y.
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Mason, Hon. E. D., Richmond, Vt.
Meddaugh, A., Friendship, Allegany Co., N. Y.
Miller, L. W., Stockton, Chautauqua Co., N.Y.
Merri, F. I., Verona, Oneida Co., N. Y.

McGillivray, D., Milverton, Perth.
McCabe, Geo., Newbury.
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McMullin, Jno., Constance, Elgin.
McKerricher, Wm., Botany, Kent.
McCombs, Jas., Scotland, Oxford.
McLean, Robt., St. Marys, Perth.
McPhail, D., Avon, Oxford.
McCollum, G., do do
McCready, N., Mt. Elgin, Oxford.
Macauley, A., Ingersoll, do
McDonald, D. S., do do
McEwan, Jno., do do
McDonald, J. F., do do
McDonald, Jno., do do
McCaughey, Jas., do do
MacAdams, Wm., Rome, N. Y.
MacAdams, John, do do
MacAdams, Alexander, Rome, N. Y.
MacAdams, Robert, Lee Centre, do
MacAdams, Geo. G., Rome, do
McGuffie, A., Herkimer, do
MacGarm, Verona, do
McWain, H. G., Boonville, do
McGaw, Wm., Buel, do
McLean, J. R., Elgin, Ill.

Noxon, Jas., Ingersoll, Oxford.
Nellis, Wm., Salford, do
Noxon, Freeman, Ingersoll, Oxford.
Newcomb, N., Ostrander, do
Nancekeivel, W., Ingersoll, do
Nagle, S., Delaware, Middlesex.
Norton, Edward, Farmington, Ct.
Niles, Edgar, Verona, Oneida Co., N. Y.
Nichols, Henry C., Norway, Herkimer Co., N.Y.
Nicholson, N. D., Oriskany, N. Y.

Oliver, Adam, Ingersoll, Oxford.
O'Neil, D., do do
Osborn, S., Orange Co., N. Y.
Olds, Ottis, Schuyler, Herkimer Co., N. Y.

Pearce, J. S., London.
Pratt, Thos., Ingersoll.
Partlow, Jno., do
Prouse, Thos., do
Patterson, Jas, Kerwood.
Pickard, Amos. A., St. Marys.
Patterson, F., Thamesford.
Palmer, E. C., Norwich.
Phillips, J., Cromlyn.
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Phelan, D., Ingersoll.
Pratt, D., Springford.
Post, Jas., Ingersoll.
Peters, J. M., New York City.
Peck, W. P., Winchester, Pa.
Prescott, Thomas, Walesville, Oneida Co., N. Y.
Paddock, S. D., Malone, Franklin Co., N. Y.
Powers, C. J., Hammond, St. Lawrence Co., N. Y.
Phillip, John M., Rome, Oneida Co., N. Y.
Peckham, W. N., Verona, do do

Ruckle, David, Culloden, Oxford.
Richardson, L. R., Kerwood.
Richardson, Jno., St. George.
Robertson, Jas. W., London East, Middlesex.
Richmond, R., Nilestown, do
Rowland, Harry, Ingersoll, Oxford.
Root, W. T., do do
Ranklin, J., Rome, N. Y.
Readey, Geo. W., Sennett, Oneida Co., N. Y.
Richardson, C. W., Herkimer Co., do
Ritter, John W., Rose, Wayne Co., do
Rockwell, H., Westmoreland, Oneida Co., N.Y.
Reckel, Frank, Sherburne, Oneida Co., N. Y.
Reese, G. W., Oneida, Madison Co., N. Y.
Reall, J. H., 37 So. Water street, Philadelphia, Pa.
Reeder, Eastburn, New Hope, Bucks Co., Pa.

Siple, Solomon, Burgessville, Oxford.
Small, Francis, Mt. Elgin, do
Sherman, Lemuel, Thamesville.
Sommerville, Thos., Haysville, do
Stephenson, W. H., Iona, Elgin.
Seals, H., Vienna, do
Springer, Dr., Ingersoll, Oxford.
Sheldon, C. L., Lowville, Lewis Co., N. Y.
Spears, John, Caistorville, Perth.
Shaw, Robt., Ridgetown, Kent.
Sharpnell, G. J., Ingersoll, Oxford.
Sutton, John, do do
Steinhoff. Wm., Norwich, do
Smith, Geo., Verschoyle, do
Stacey, T., Fullarton, Perth.
Sage, Z., Ingersoll, do
Smith, James, Verchovle, do
Smith, B. P., Black River, Jefferson Co., N.Y.
Smith, C. W., do do
Stiles, E., Oneida Co., N. Y.
Sheldon, C. L., Lowville, Lewis Co., N. Y.
Stephens, Fred., Rome, Box 196, N. Y.
Spinning, E. C., Taburg, Oneida Co, N. Y.
Saramo, Fred., Fort Plain, Montgomery County, N. Y.
Stephens, Alfred, Rome, N. Y.
Saunders, A. C., Leonardsville, Madison County, N. Y.
Smith, P. P., Cazenovia, Madison Co., N. Y.
Smith, L. C., Cedarville, Herkimer Co., N. Y.
Slosah, W. H., Oneida, Madison Co., N. Y.
Slosah, Richard, Ridge Mills, N. Y.
Smith, C. H., North Hebron, N. Y.
Schemmerhorn, J. M., North Gage, Oneida Co., N. Y.
Schemmerhorn, C., North Gage, Oneida Co., N. Y.
Shufelt, S. J., North Gage, Oneida Co. N. Y.
Stirling & Bingham, Watertown, N. Y.
Shull, Hon. Josiah, Ilion, Herkimer Co., N. Y.
Seymour, Hon. Horatio, Utica, N. Y.
Stewart, Prof. E. W., Lake View, N. Y.
Scoville, J. V. H., Paris, Oneida Co., N. Y.
Straight, S., Hudson, O.
Sterling, E. B., Watertown, N, Y,

Tripp, Wm., Mt. Elgin, Oxford Co.
Treffry, G. H., Hawery, do
Tennant, J. R., Richwood, do
Tullock, W. R., Mossley, do
Templeton, F. D., Verschoyle, do
Topping, Henry, Springfield, do
Thompson, George, Ingersoll, do
Thompson, Lewis, do do
Turner, J., do do
Thompson, D., Florence West.
Taylor, A., Aylmer, Elgin Co.
Tucker, C. E., Herkimer, N. Y.
Tucker, E. B., Hannibal, Oswego Co., N. Y.
Tremain, Charles, Manlius, N. Y.
Talcott, George S., Salisbury Centre, Herkimer, N. Y.
Trumball, S. R., Pulaski, N. Y.

Vrooman, J., Rochester, Olmstead Co., Minn.

Weaver, Sylvenus, Otterville, Oxford.
Wilkinson, James, Verchoyle, do
Wilkinson, Wm., Ingersoll, do
Wilkinson, John, do do
Watson, W., Bookton, do
Wilson, Leonard, Ingersoll, do
Williams, James F., Culloden, do
Wilson, D. G., Ridgetown, Kent.
Wood, Andrew, Wolverton, Perth.
Weeks, Nicholas P., Botany, Kent.
Warner, Warren, Laurence, Elgin.
Waddell, Wm., Culloden, Oxford.
Wilson, John, M., Woodstock, do
Walter, Wilson, Bennington, do
Waters, H. W., 31 Front St. East, Toronto.
Wilson, Henry, Lambeth, Kent.
Webb, W., Drawer 24, London, Middlesex.
Wagner, Wm. J., Belmont, do
Williamson, Robt., Ingersoll, Oxford.
Woodroofe, R. W., do do
Walley, John, do do
Webster, Wm., do do
Wilson, J. M., do do
White, D., do do
Weaver, Jos., Otterville, do
Watterworth, Wm., Ingersoll, do
Wilson, Chas., Ingersoll, do
Watson, Wm., Falkirk.
Walker, Jas, Norwich, do
Woodcock, R. A., Ingersoll, do
Wilson & Robertson, do do
Wetherell, Leander, Boston, Mass.
Willard, X. A., Fairfield, Herkimer Co., N. Y.
Whitney, W. M., Philadelphia, Jefferson Co. N. Y.
Wilgus, M. G., Pike, Wyoming Co., N. Y.
Williams David, Rome, N. Y.
Wait, George R., Hartford, Washington Co., N. Y.
Williams, Roger, Briar Hill, St. Lawrence Co., N. Y.
Whitman and Burrell, Little Falls, Herkimer Co., N. Y.
White, Lunth & Co., Sherburne, Chenango Co., N. Y.
Williams, George, Whitestown, Oneida Co. N. Y.
Waller, G. W., Newport, Herkimer Co., N.Y.
Ward, Artemas, Philadelphia, P. A.
Wilkinson, Prof. J., Baltimore, Maryland.
Wight, Dr. L. L., Whitesboro, N. Y.
Weeks, G. B., Syracuse, N. Y.
Wheeler, M. H., Bridgewater, Oneida Co., N. Y.
Wright, George R., Harford, Washington Co. N. Y.

Young, D. G., Cedarville, Herkimer Co., N. Y.
Yourdan, O., North Western, Oneida Co., N.Y.

TRANSACTIONS

OF THE

TWELFTH ANNUAL CONVENTION

OF

The American Dairymen's Association,

HELD IN INGERSOLL, ONT.,

TUESDAY, WEDNESDAY AND THURSDAY,

JANUARY 10th, 11th, and 12th, 1877.

The Convention assembled January 10th, at Ingersoll, Ontario, Canada, under the auspices of the Ingersoll Board of Trade, and was called to order at 11 a. m. by Wm. S. King, President of the Board, who said :

LADIES AND GENTLEMEN,—It affords me and the people of Ingersoll and its vicinity much pleasure in giving a hearty welcome to our American friends on this occasion. Everything will be done to make this meeting a success. I have no doubt but we shall derive no small benefit from this Convention, and I trust we will be able to render some assistance to our friends from the other side of the lines.

At all your meetings some member of the Board will be present to render every possible assistance we can in conducting its business.

In the absence of the Hon. Horatio Seymour, President of the Association, the chair was taken by Mr. C. E. Chadwick, of Ingersoll, one of the Vice-Presidents, who spoke as follows :

GENTLEMEN,—I can only reiterate what my friend Mr. King has said, that we give our American friends a most cordial welcome. I must say I think they have exercised a great deal of taste in coming here in the central part of the dairy interest of Canada, where we shall be able to give them some useful lessons, I trust.

We are always ready to extend to our American brethren the right hand of fellowship, and I have no doubt that the holding of this Convention on the northern side of the great lakes will prove to be a wisely taken step, and one that will result advantageously to both American and Canadian dairymen. The Convention is now open for the transaction of business.

On motion duly made and seconded, the chairman appointed the following Committee on the Order of Business :—Hon. Harris Lewis, of

Frankfort, N. Y.; Mr. Geo. Hamilton, of Cromarty, Ont.; Mr. E. Casswell and Mr. J. C. Hegler, of Ingersoll, Ont.; Mr. H. M. Kennedy, of Utica (N. Y.,) *Herald*, and Mr. J. S. Pearce, of London. The Convention then adjourned till two p. m.

AFTERNOON SESSION.

At two o'clock Vice-President Chadwick called the Convention to order, and said :—I am pleased to see a much larger attendance than in the morning, and I trust this will be an interesting session. This is, I may say, an important gathering, at which a large amount of information may be disseminated. The interest that has been manifested from year to year, shows that the knowledge thus disseminated has been productive of much good, and contributed largely to our material interests. I believe those of you who can look back eight or ten years will be willing to admit that the large amount of information obtained from these meetings, has been applied to the development of those important interests with which we are connected, and that it has brought about an almost entire revolution in the agricultural and dairy interests of our country. It is in such gatherings as these where we can meet together, and receive and impart much useful knowledge that may be applied to the advancement of this interest which no doubt is still in its infancy. I trust that this meeting will not be behind any other that has ever been held in this place in interest and usefulness. We Canadians are greatly indebted to our American friends who have contributed so often to the interest and usefulness of our meetings, and when we have visited them they have always received us and treated us in a most kindly way, and I trust we will ever receive them and treat them in the same spirit to which they are entitled at our hands.

The first thing on the programme is a paper by Mr. A. L. Fish, of Cedarville, N. Y. Mr. Fish not being present, his paper will be read by the Secretary.

Upon coming forward with Mr. Fish's paper, Secretary Arnold said :—As questions and discussions are always in order at the close of papers and addresses, I will, if you please, in the absence of Mr. Fish, assume the task of answering as far as I am able, such questions as the reading of his paper may suggest. The paper is as follows :

APPLICATION OF HEAT IN THE DAIRY.

Mr. President, Ladies and Gentlemen,—My object in selecting heat as a subject of some remarks, is to impress dairymen and manufacturers of cheese and butter, with a necessity of giving due attention to the influence of *heat* as a constructive and destructive agent, pointing to its essential aids in the practical business of life when equipoised by mediate agencies. In discussing a subject whose relations are involved in a vast variety of material things, whose constituents are changed and shifted from one form to that of others, we are wont to inquire for a description of the immediate cause of effects we realize. We are forced to the conclusion that heat is the moving cause of all the physical and mechanical energies of the universe. But the most learned have failed to define its materiality, or do more than to use the term heat as expressive of condition. As a condition it is capable of augmentation to destroy the work its influence is required to build (unless equipoised by

mediate agencies). All vegetable and animal life and growth are from the influence of heat, acting chemically upon the constituents of matter to fit their condition, to shift from one form into that of other forms. By its influence the circulating elements are made replete with plant food, and the constitution of the vegetable kingdom is adapted to select its appropriate nutriment therefrom. Through the vegetable kingdom, and by like influences, animal life is sustained. Excess of heat destroys its noble work in both. A glance of the mind at our summer scenes reminds us of Nature's beautiful and instructive example in casting the shades of night over mother earth, to give her time to radiate into universal space her surplus heat derived from midday sun, by which an equilibrium is preserved congenial to vegetable and animal production. The green fields of the husbandman, dotted with beautiful herds, and blooming with verdure ; the tasteful garden beaming with the luxuries of life ; the fruit trees, bending beneath their lucious weight; ornamental shrubberry delighting the eye with its tasteful elegance; and the horticultural gardens, loading with their sweet perfumes the zephyrs of summer, bear witness to the genial influence of heat when kept in check by mediate agencies. Following this train of thought onward we realize that heat nerves the arm to unearth the integrated minerals, and brings them to a condition to be moulded into forms suited to our wants. It builds our houses, tills the ground and matures its product, and its influence is genial aid in all the varied spheres of men while kept subservient to our use. Nature has fixed a point in temperature of the atmosphere and blood of animals, at which it is constructive in physical organisms. In excess of that point it is destructive to the objects it has been efficient in consumating ; it brings solids into liquids and liquids into vapor and mist, by insinuating between the particles of matter unseen, and forces them asunder into minute subdivisions. It is opposed to cohesion or unison of particles, and when in excess its influence is manifest in explosions, conflagrations, withered plants, tainted meat and cheese, and stale butter.

The chemist, the mechanic and manufacturer, need to understand the effect of heat in excess in each particular sphere. The smith learns the amount of heat required to bring the metals he works into condition to meet his handiwork, but when the shape is formed he rejects the heat entire —but not so with cheesemakers. They have first to bring the fluid mass (milk) into a temperature suited to a uniform and efficient action of rennet, as an accompanying agent, to effect a partial decomposition, which must not be carried to a complete separation of constituents, because part of the fluid portions of milk must be retained intact. If separated by the vaporizing influence of heat they will not again unite with the curd as a milk constituent, or component of cheese. If a thin slice of the closest worked curd (after being pressed into cheese) be dried it breaks like glass, which proves that it is retention of water that makes cheese plastic in texture. The sugar of milk combined with salt give cheese its aromatic flavor so much desired by the purchaser. The oils being volatile, work off too freely with the whey at a high heat. The most perfect solids are formed by cohesion acting upon particles of the closest affinity. If a portion of milk or curd is exposed to higher heat than other portions of the mass, it is unfit for a perfect union. The office of

rennet, with the aid of heat, is to bring the constituents of milk to a common unity, which no other property will do as well.

The stomach of different animals will digest the same kind of food upon a given principle. But the stomach of one species of animals will not digest food suitably to form the flesh and bone of other species, nor will other properties coagulate cows milk in a manner to cheese the curd as well as the stomach of the same species as those giving the milk. Rennets accompanying the agent (heat) must be discreetly suited to its action upon the milk and curd. If rennet is weak and slow, heat must be kept back to keep pace with its action, if strong and quick, heat may be raised faster. As neither will do the work alone, their action should be equipoised, as curd is a slow conductor of heat, there is danger of exposing it suddenly to higher heat, because the lumps will become coated over with an impervious skin, through which the fluids within cannot pass freely, which results in a rough, loose meated or swollen cheese. To illustrate the point I wish to impress, I will relate an instance in my experience. I had marketed a dairy several years made by an English lady of much experience in cheese making, and who was not excelled in cheese making. The next season, in May, the cheese made by the same hand was loose meated, sour and unsalable. Searching for the cause I stood mutely by the tub till the curd was worked up all right, when two pails of whey, heated to 160 degrees, was brought to pour directly into the tub, which I stopped, and mixed a pan of the hot whey with the surface whey at a time, till the mass was raised to blood-heat and no more, taking an hour in raising the heat. The result was a perfect cheese, and continued so from like applications of heat. It is evident in this case that too sudden and partial exposure to high heat caused an uneveness in the condition of the curd. And do we not now, in the present mode of heating, expose a portion of milk and curd to a degree of heat that subjects it to waste in the manipulating process, and unfits it for perfect coherence in cheesing the curd? Mechanics have succeeded in distributing heat around the inner vat more evenly than formerly, yet there is much to be gained beyond the present mode of heating. The mechanic, in constructing cheese vats, should hold several essential points in view: first,—that the tendency of heat in fluids is upwards; second,—the tendency of curd in the process of manipulation is downwards to the bottom of the vat; third,—the thinner the sheet of water or steam between the vats into which heat is forced, the sharper will be the heat, and hotter the heating surface of the inner vat; fourth,—the wider the space between the two vats the milder and more even will be the effect of heat through that medium. The most perfect success I ever achieved in thirty years of practical experience in cheese making, was wrought by keeping water between the vats at blood heat, and no more, thereby the heating surface of the inner vat was not in contact with a particle of milk or curd above blood heat, consequently, no lack or excess of heat caused antagonisims to prevent perfect union of cheese constituents. The surface of each lump of curd serves as a strainer, through which its interior fluids must pass to be freed from the curd, therefore, they should not be skinned over by exposure to high heat; a moment's reflection will point to the result. Set at 80 to 84 degrees, till coagulation is well formed, then not expose to more than blood heat,

will retard acidulation, and favor efficient action of rennet. To improve the present mode of heating I would recommend widening the heating space between vats, especially at the sides, to 10 or 12 inches, so heat may be equalized before reaching the bottom of the inner vat where the curdinclines to settle and rest. And instead of forcing currents of heat towards the inner vat, I would point them outward and downward towards the outer vat at various points. Having completed cooking the curd (so-called) the action of rennet is checked by suppressing heat, which should not be done suddenly to chill the curd. All changes of temperature should be made slowly to effect the mass evenly. We must not release ourselves from due restraint of heat while cheesing the curd, after it is pressed, for in this process a continuous action of heat and rennet, with the new agent (salt), must be kept steadily on, with unvarying temperature, not exceeding seventy degrees. If too cold fermentation ceases, and the effect of acid predominates, and hard crumbly texture of cheese is the result ; if too warm, fermentation is too rapid for a perfect union of constituents, and the cheese swells, forming cavities in which fluids in gaseous state collect, becomes fetid (out of flavor), and imparts its vicious odor to the mass. Cheese, when suited to a special demand, like luscious fruit, should be placed in a temperature too low to admit of a continued action of the decomposing agents, heat and rennet. All cheese factories should have an adjacent room in which cheese can be held at a low temperature, and thus kept like canned fruit, to meet a favorable demand. As most of our curing rooms are constructed and now used, it is impossible to preserve a well made cheese in them from damage by frequent admittance of external influences. Thus a large portion of the most profitable product of the dairy, it being made from spontaneous forage, grass in the flush of feed, gets out of flavor, troublesome to keep at home, and much more so in foreign markets. It is thence crowded upon the markets in bad condition, to increase a demand proportionate to the increasing supply. Having previously given my views upon the proper construction of curing rooms, and the practical relations of milk producers and factorymen, which are before the public, I shall not rehearse them, but leave them with those I have now presented, trusting that if in error, those errors will be corrected by others of more skill and wider range of practical experience.

QUESTIONS AND DISCUSSION.

H. Farrington—I wish to ask whether for keeping the curd from packing, efficient stirring would not be sufficient, and thus save the expense of heating the extra amount of water as recommended by Mr. Fish ?

Prof. Arnold—It is very important in raising the temperature that it should be done very gradually, and this requires time. To stir for so long a time would greatly increase labor and waste.

Mr. Farrington—The change in the vats recommended by Mr. Fish would cost considerable. In the first place, they would have to be about six feet wide instead of four, and would thus take up a great amount of room in the building.

Mr. Losee—I agree with Mr. Fish in having this large space at the bottom. I have had some experience in having large space at the bottom

of the vats, and I find you can raise the curd with less difficulty and a more even heat, and the additional expense was very little.

Prof. Arnold—This question of raising the temperature of the curd is an extremely vexatious one to dairymen, and it is the cause of much trouble. If it is not raised very evenly some portions of the curd pack, become hard and advance faster than others, and will continue to keep ahead. It keeps that start, and continues to mature faster when it goes to press. That portion of the curd ripens earlier. If, on the other hand, some portions of curd near the top of the vat, become cooler, they fall behind, and never catch up. This keeps a constant unevenness, and the cheese, when it ripens, has a cloudy appearance. Some portions retain their color, others become discolored, for the reason that the development of acid destroys the influence of the coloring, and makes it lighter. How often do we see this. We do not notice it when it is new, but when it comes to ripen we do see it, and it injures the sale of the cheese. My idea of a perfect method of making cheese is to apply the rennet at the temperature at which you desire to work the curd, and maintain it at that temperature all the way through. With our present notions of making cheese this appears hardly possible; but I believe we must come to it. I have tried experiments pretty carefully by letting the curd lie in the whey unstirred, covering the vat so as to retain the heat several hours, but the curd took a bad flavor from the whey. I throw out this remark with the hope that some one will construct a vat with which you can maintain a uniform heat, and by which you can drain off the whey as fast as it is formed, tipping the vat and letting the curd remain at one end, and finish it as Cheddar cheese. I saw a vat which had some of the necessary characteristics. It was the invention of a Mr. Armstrong, of Vermont. It was constructed with an arch connecting with the flue so that the fire traversed the whole length of the vat to warm the arch, which could be closed entirely so that no current of air passed through it. Then a tight cover was placed upon the vat, so as to keep the mass from cooling on the top, and it remained in one instance six and a-half and in another over seven hours without varying a degree. If so constructed as to maintain a uniform heat, I see no reason why we may not work the curd at a uniform temperature, and save all the effects of uneven scalding. I hope dairymen will experiment on that point.

Mr. Losee—Mr. Fish spoke of a skin coating that formed around the lump of curd by heating. Now, will this be more liable when the curd is cut softer or when cut harder?

Prof. Arnold—It is the soft curd which is more liable to the skinning process.

Mr. Farrington—The great practical question is, whether the benefit would be sufficient to involve the expense when we take into consideration that during the process the surrounding atmosphere is very little different from what we want. Inasmuch as the heat can be let on by degrees and can be shut off at will, may we not heat so evenly as to dispense with this great amount of water? We may theorize upon it, but what we want, as you say, is experiment.

Prof. Arnold—In reading an account of the methods adopted in Switzerland I see it is stated that some heat the milk to 120 degrees,

and apply the rennet at that temperature, and they certainly succeed in making a splendid cheese.

Prof. E. W. Stewart—Has that degree of heat ever been tried in this country?

Prof. Arnold—I think not. I have several times scalded the curd to 120 without injury.

Mr. Lambert—I have dipped curd many times when scalded up to 96, and considered I had sufficient acid.

Prof. Arnold—The phrase "cooking and scalding the curd to produce acid," is a misnomer. The object is not to cook or scald to produce acid, but to hasten the changes, and separate the whey from the curd. We must relieve the curd of a certain amount of whey, else when we ripen it in the curing room it will have a bad appearance and a bad flavor. I do not regard acidity of much consequence in the separation of the whey. I may not be right in that, it is a matter of theory more than practice. I believe we can make as fine cheese without developing acid as with it. Those cheese that have the least acid have the most nutty flavor, for the reason that the essential oils which impart the nutty flavor are dissolved out by contact with acid. The acid "cuts" them—so to speak—the same as alcohol is said to "cut" or dissolve oils—and then these oils are carried off in the whey, and the cheese becomes insipid. There is a distinction between *cheesy* flavor and *nutty* flavor. The former is developed in the conversion of curd into cheese; the latter from the flavoring oils of the herbage on which the cows feed. Either may exist without the other. Both are present in a perfect cheese. The nutty flavor is very important in cheese as it is also in butter. It is that for which cheese fanciers are willing to pay a high price. The development of much acidity dissolves it out and it is carried off in the whey.

Mr. Losee—Can you give any particular mode or system by which the water can be extracted from the curd without acidity?

Prof. Arnold—The action of the rennet separates it.

Mr. Losee—Does not the acid called Lactic acid have that effect?

Prof. Arnold—Yes.

Mr. Farrington—If milk be mature by age, and then made into cheese, without waiting for the acid to develop, in the usual manner, will it not make far better cheese than milk fresh from the cows?

Prof. Arnold—It will.

Prof. Stewart—I would ask whether the advice to draw off the whey as soon as it is formed, is for the purpose of preventing the formation of acid?

Prof. Arnold—It is rather to prevent the foreign taints which the milk of some seasons contain, from reflecting their bad influences on the curd. During the hot weather of July and August, from impure water or unwholesome food, the milk and whey become tainted, so to speak. These foreign taints develop and spread rapidly in the warm whey, and impart their bad flavors to the curd that lies in it. It is to avoid the reaction upon the curd of these foreign flavors that I would remove the whey as soon as possible. If the milk was perfectly pure that reaction would not produce such an unfavorable effect. But if the whey of such milk

even were left on till it becomes sour, you would not get that perfect nutty flavor in the cheese.

Mr. Losee—Would not these taints be eradicated from the milk in extremely hot weather if, as soon as it was taken from the cow, it was cooled down to 60 degrees?

Prof. Arnold—It would diminish them, but not remove them thoroughly.

Mr. Losee—I contend that that would be the greatest improvement in cheese making, and I think could be made at little expense.

The chairman now announced a paper by John Stewart, of Manchester, Iowa, on

BUTTER MAKING AT THE WEST.

A few years ago it was very difficult to convince our Eastern merchants that fine butter could be made in the West. And we of the West had become so accustomed to seeing Western butter quoted in the Eastern market reports separately, and at very much lower prices, we had almost come to the conclusion that the art of making fine butter was out of our sphere. This discrimination was millions of dollars against the West annually. We are free to confess that until a very recent period the discrimmination was just. It was thought by some that there was something wrong with our soil or water. Others attributed it to our wild grasses, and there were not a few who were of the opinion that we had not a butter making population. I am very sure that none of these opinions had the slightest foundation. There is no section of the United States, and I believe in the world, that is better adapted to butter making than northern Illinois, southern Wisconsin, Iowa and southern Minnesota. For soil, water, climate and atmosphere, it cannot be surpassed, and as for the opinion that wild prairie grass is not good for making butter it is a great mistake. Wild grass is just as good as any other for butter as long as it keeps green. The great objection to it is, it only remains green from three to four months during the year. Butter made from prairie grass will keep longer than that made from our tame grasses. I cannot stop to give you the theory for this, but I know it to be a fact. Prof. Arnold will give you the wherefore. As to our population not being good butter makers, I will simply say that a large majority of the population of the sections named above are from the best butter States in the East, and formerly made fine butter there, so that the cause of our not sending good butter East in former years must have been something else. I will give what I conceive to be three principle causes. In the first place, our farmers had not the conveniences they had East, their attention being taken up with grain growing, raising beef cattle and hogs, did not give the dairy interest proper attention. Very few of them had a place fit to keep milk in. They have, however, made a great deal of improvement in this direction in the past ten years, and as these improvements have progressed the quality of the general make of butter has improved proportionately. Another great draw-back to the butter making interest at the West was the lack of a proper system for transporting butter in warm weather to Eastern markets. If the butter had been ever so fine before it started, it would have been so injured by the heat by the time it reached its destination, it would not

sell for anything but low-grade butter. I am glad to say this difficulty has been entirely overcome, so that we can now have refrigerator cars sent us on any line of railroad in the Western States, and can place it in the Eastern markets in as good condition as when taken out of the creamery. There was still another thing that helped to bring our butter into disrepute. It was the way in which it was handled by the merchants. It was packed altogether regardless of color or quality, and when a trier full was drawn it resembled Jacob's herd, "Ring-streaked and striped." This evil has also been overcome, there are now in nearly every town one or more men who make it their business to sort and pack the butter, and thus an even color and quality is secured.

I have thus hinted at some of the changes that have been gradually bringing our butter toward a level with Eastern. Five or six years ago the creamery system was adopted by a few at first as an experiment, and the butter manufactured was found to be superior to that manufactured at the private dairy. As soon as it was ascertained to be a success the number of creameries began to increase. For the first two or three years this butter was marketed in Western cities, the prejudice that existed in the East against Western butter precluded the possibility of getting the price that a limited trade for fancy butter in Western cities was willing to pay. But as this make of fine butter increased it was necessary to seek an Eastern outlet. The commission men East who received these consignments found hard fighting to remove the prejudice and get for the butter its real value. In some instances it had to be repacked into Orange Co. pails to make it sell to the fancy trade. As they began to use the butter they found that in all the qualities essential to good butter it was fully up to the standard of Eastern, and in keeping qualities ahead. So that we can now announce the middle wall of partition that has so long existed between the East and West crumbling, and may now be classed among the things that have passed away. The awards at the Centennial Exposition will confirm these statements. And the fact that to-day this creamery butter is bringing two cents per lb. more thon the highest quotation for Orange Co. pails, sets this question of Eastern and Western butter at rest, so that we can for the first time in the history of our Nation clasp hands over the bloody chasm. The inquiry will naturally arise, what is this creamery system you have adopted that has brought your butter so suddenly to such a high standard? I will answer this inquiry as briefly as possible. As I am best acquainted with the Iowa creameries, I will speak more particularly of them, and I think the system is best, as cheese and butter making are not combined. I cannot give all the particulars, but will name a few of the principle ones. The buildings are usually of wood, and are constructed with a view to a proper and even temperature. For from 300 to 400 cows the buildings are about 24 x 48 feet, the lower rooms are half below and half above ground, with cement floor; milk room 24 x 36; churn and work room 12 x 24. Ventilator up through the middle of the milk room. Pans are 2 feet wide and 4 feet long, and 14 inches deep. During warm weather these pans are set in water vats; the water is supplied either from a flowing spring or pumped by the same power that the churning is done. The milk is brought in every morning and evening. Milk room kept at a temperature of 62°

to 65°, which will raise the cream in thirty-six hours. But in muggy weather or when there is considerable thunder and lightning, it is often necessary to skim sooner. This is one of the most particular points in butter making. The cream must be taken off at just the right time, no difference what other work has to be neglected this must be attended to in its season. The milk should never be allowed to lopper before taking off the cream. The kind of churns used are the square box revolving churn with no paddles nor dash. The cream when put in the churn should be a little acid, and in warm weather at a temperature of 58°, and in cool weather 62° to 65°. The churning is done by horse power, and from thirty to forty-five minutes is required to bring the butter. Churning should cease the moment the butter comes before it forms in mass. The buttermilk is then drawn off, and cool, clear brine thrown in and drawn off until it runs through clear. The churn is kept in slight motion with the hand back and forth until the washing is finished. The butter is then put into the worker, and the salt is thoroughly worked through it, about $\frac{3}{4}$ oz. per lb. It is then set away twenty-four hours, when it is again worked and washed with brine until the brine in the butter is clear. The Pkg. is soaked with strong brine twenty-four hours before putting in the butter. This creamery system is becoming very popular among the farmers. They get all the sour milk back, which is estimated to be worth from twenty to thirty cents per 100 lbs. to feed to hogs.

If these creameries multiply and increase the next ten years as they promise to do at present, the bulk of the butter in the West will be made in this way. Some are fearful that the butter making business will be overdone on account of the increased make by the creamery system. But I take a different view. It is true the amount made will be greatly increased, but it will be of such a quality that the consumption will be increased proportionately. There is no reason why we cannot supply our neighbors across the water. Butter can be transported from Iowa to Liverpool for about $2\frac{1}{4}$ cents per lb., and with land worth only twenty to thirty dollars per acre, there is no reason why we cannot compete with a country where land is worth from hundreds to thousands of dollars per acre, with no superior advantage in the production of grass, and where grain is worth three times what it is in the West.

DISCUSSION.

The chairman called upon Mr. Lewis for his opinion of the comparative merits of Eastern and Western butter at the Centennial.

Mr. Lewis—I think that the superiority of the Western butter at the Centennial was owing to its being transported in refrigerator cars, and iced twice over on the way, and kept on ice till just before the award was made, while the other was shipped in ordinary cars, and stood a long time in unfavorable conditions till examined. I think that these different circumstances ought to have been taken into consideration in making the award. I believe that if it had been shipped as ours was, it would still have been Western butter. (Laughter.)

Mr. E. Casswell—I would ask Mr. Lewis whether the ride from Iowa to Philadelphia would give the color and flavor which the Western butter had above all others?

Mr. Lewis—I would ask Mr. Casswell if coloring butter with Michell's Annatto would make it any better? (Laughter and applause.)

Prof. Arnold—The remarks made by Mr. Lewis have some force. The butter from the West came there in better condition than that from the East. It had the advantage on that account. They have doubtless used more skill. Knowing that to compete with the East it was necessary to use all the means at their command, every new idea that comes up they are ready to take hold of, while we remain in the rut. They have thus got a-head of their ancestors. Mr. Stewart says they keep their milk rooms at a temperature of 60 to 65 degrees. It is an important item to keep the milk cool. Our Eastern men keep the milk-room warm and the milk cold. Not a few advocate keeping the air at 70° and the milk at 60° or below. The effect of this is to make the top strata of the cream unduly ripe, while the lower strata is little advanced, and by the time it is taken off, the top exposed to the air at 70 degrees, has become quite stale. It is a small fraction to be sure that becomes stale and does not show itself prominently at first, but there is no doubt that this stale cream, carried into the butter, will soon communicate its effects to the whole mass. This is one reason why our Eastern butter does not keep as well as some prairie butter. It is important that the cream should be ripened evenly. The Western butter has the advantage on another account. Grain in the West is cheap, and they feed it freely to their cows. They feed meal even in June, and it makes better butter, gives a higher flavor, and makes it more solid. May I offer a little light on this subject. This Mr. Stewart who took Iowa butter to the Centennial was a most sharp and shrewd fellow. He was as full of shrewdness and cunning as an egg is of meat. He brought his butter there at the very last, had it all the way under ice, and kept it so, and then put it in along side of butter that had been there three weeks or more exposed to all the changes of the atmosphere. Had it been subject to the trial of the Eastern butter the result would have been quite different. Mr. Stewart's butter came there under the most favorable circumstances, and by his cunning and sharp practice succeeded in obtaining the premium, and I don't know but he deserved it. To show you the difference I will tell you what I saw. About the last of July I had occasion to help to open a butter car from the East. It was an ordinary car, and some of this butter had been thrown down, and was strewn all over the car floor. Now, who in the world would expect anything else of butter sent in that condition and compared with butter carried with the greatest care in refrigerator cars. I really think the judges should have taken the different conditions under which the butter was shipped in the account.

Mr. Farrington—I would ask Mr. Lewis whether if the Western butter had not been good when it started to Philadelphia, it would have been good when it got there? (Laughter.)

Mr. Lewis—Mr. Farrington has me now. (Laughter.) I will answer. The butter was good when it left home, and it did not lose anything in its transit. I would here say with reference to the remarks of Prof. Arnold on feeding grain, there is nothing under Heaven so nice for butter as June grass, only get enough of it. (Laughter.)

Prof. Arnold—I beg leave to make a few remarks further on this subject. Mr. Boise, of Marengo, Ill., is a high feeder. He has a splendid June grass farm, large enough to keep a 100 cows or more. It is covered

with June grass, and produces nothing else but June grass. I was there in June, and it was as green as grass could well be, and he fed his cows liberally with a mixture of corn and oatmeal, wheat bran, and a small quantity of oil cake. I visited his factories, examined the milk and butter, as also other factories where they fed nothing but grass, and the difference was very marked. Mr. Boise's butter was selling by the thousand pounds at three cents a pound above the highest quotations of butter in Boston, New York and Philadelphia. Grain feeding seemed to give a richness, solidity, flavor, and high color that does not belong to grass butter.

Prof. Stewart—I think this a very important matter now under consideration. It shows the commercial value of skilled labor. The time coming when skill will win. I don't think the Eastern makers ought to complain that in the awards the different methods of transportation was not taken into account. The consumer will prefer good butter to poor, no matter how many excuses may be offered for the latter. It would not matter with him whether butter from good milk was spoiled by a bad dairy room, faulty making, or faulty transportation. He will give preference to the butter having the most desirable qualities when it comes to him, and it was the duty of the judges to do the same. The West have believed that they had greatly inferior grasses, water, and other unfavorable circumstances surrounding them, and they determined by extra skill to succeed ; they have done it, and they have justly earned the award. It seems to me that hereafter the way to succeed is to make use of our brains ; brains must win. If we could have all of the best grasses to feed our cows, each grass possessing its peculiar aroma, and if we could concentrate them all in our butter, we would no doubt have a most admirable article ; but if it had them all, and did not retain them till it reached the consumer, it would be of no avail. The fact is, we take so little pains in the manufacture of our butter, that its keeping qualities are such that it don't retain the best flavor of a single grass or a single kind of food. That which Mr. Lewis calls the adroitness or sharpness of Mr. Stewart, is simply skill. We would say that their success was the result of wise judgment and care. Hereafter we must understand that unless we use the same skill and judgment we will be outstripped in the race.

Mr. Casswell—I have seen so much butter and cheese destroyed by transportation, so much injury and loss through carelessness, that I feel this matter is of the utmost importance, and would urge this meeting to do all that possibly can be done to remove or lessen this evil. In almost every instance of failure it is through carelessness. I am surprised that a country so far advanced as that in which Mr. Lewis resides, having so long had so many useful organizations in operation, that they should ever admit that they sent their butter under such unfavorable circumstances : surely they ought to have sent it down as Mr. Stewart did.

Mr. Lewis—Those living in Chicago and West of there have the advantage of their competing railroads, and they can get an ice car to New York city filled three times over for less money than we can get an ordinary car from central New York. We are under the thumb of the railroad company. They can do with us just as they please. This is the

explanation. The Eastern exhibitors could not have obtained an ice car if they had tried.

Mr. Farrington—New York State got its name up long ago for butter and cheese making, and when their sons went West they were exactly in the opposite position, wanting most of the conveniences and advantages of the East, but their spirit of enterprise being aroused, it has brought forth its legitimate fruit.

Mr. C. B. Lambert, of St. Thomas, being called upon in reference to experiments in cheese making, said :—My experience in cheese manufacture dates back only four years, but I have made it a study, and have experimented as far as time would permit. Cheese makers are generally aware that in the ordinary process a part of the nutriment in the milk—the albumen—runs off with the whey, not being coagulated by rennet. My efforts have been to retain this in the curd. I think I have accomplished this by the use of nitric acid and drawing the whey early. I scald the curd to 90 degrees, and before grinding put it into the hoop and press the whey out, surrounding the hoop with water at 98°, and in this way retain 25 per cent. more albumen than by the old process, making in August a pound of cheese from eight pounds of milk.

Prof. Stewart—Was the cheese analyzed ?

Mr. Lambert—It was not.

Mr. Losee—How did you keep water around the hoop ?

Mr. Lambert—By surrounding the hoop with cloths and pouring on warm water.

Prof. Arnold being called upon said : Milk contains on an average one half per cent. of albumen and three per cent. of casein. The albumen is not subject to the action of the rennet. It remains a perfect fluid in the milk under all ordinary circumstances, and can only be coagulated under the influence of acid, and not even then unless the heat is increased to nearly the boiling point, when it will coagulate and may be collected in a filter. It is like the white of an egg. I think Mr. Lambert is mistaken altogether in his idea of retaining the albumen. I can see no possible way of retaining any more albumen in the way he describes than in the ordinary process. His mistake, I think, is attributable to an increased quantity of curd and the retention of more water. As to the curing of it I would say that when I was here in September Mr. Lambert had the kindness to present me with one of his cheese. I kept it till nearly January, and when I cut it it soon became quite hard and dry, like skimmed cheese. It had retained an unusual amount of water.

Mr. Casswell—What would be the effect of hot weather on such cheese ?

Prof. Arnold—It would not stand up well.

Question—What quantity of salt would you recommend ?

Prof. Arnold—That would depend on the condition of the curd. If it was dry, two pounds would be enough. When there is whey in the curd a part of the salt is washed away. Ordinarily $2\frac{3}{4}$ lbs. are sufficient.

EVENING SESSION.

Vice-President Chadwick called the Convention to order at 7.30, and introduced Prof. L. B. Arnold, who, in coming forward, said : The paper I am about to read is confined to the facts in regard to the dairy display at Philadelphia rather than to philosophizing upon it. If questions arise

in respect to the matter of the address, I shall be pleased to answer them at any time.

DAIRY AT THE CENTENNIAL.

The great susceptibility of dairy products, especially butter, to the influence of heat and atmospheric agencies, rendered special preparation for their care while on exhibition a matter of necessity. This work the dairymen of the country, under the auspices of the American Dairymen's Association, assumed at the annual convention of that Association, held at Rome, N. Y., in January last. $800 were subscribed by the members of the Association to begin the work with, and a Committee which had been previously appointed was enlarged, to prosecute the work to the end. With commendable exertions money was raised by private subscription in New York, Vermont, Pennsylvania and Ohio, and also by legislative aid in N. Y., and a model butter and cheese factory, with ample rooms for the display of butter and cheese, and for a complete outfit of apparatus necessary to the manufacture of both butter and cheese, was erected, at a cost of $10,000. Of this sum $2,000 were contributed by the Canadian Government. This structure, which was located just east of the Agricultural Hall, was 115x36 feet on the ground, with its longest dimension lying north and south. On the east side at either end was an annex, 64x30 feet, extending out parallel to each other, giving to the ground plan something of the form of the letter U. For the money contributed by Canada, the lower floor of tho northern annex was set apart for the especial use of dairy products of that country, and it was occupied during the entire season with relays of Canadian cheese. The lower floor of the south annex was devoted to cheese from the United States.

A room about twenty-six feet square was partitioned off from either end of the main structure, that on the south end for fancy and foreign cheese, the one on the north end for butter. The centre of the building between these two rooms, was occupied with two apartments for the display of dairy apparatus. The butter and cheese display rooms were fittted with appropriate shelving, and the room for butter was supplied with the necessary means of refrigeration. Against my protest, and in direct violation of a double pledge by D. L. Pope, chairman of the Executive Committee, and, as it proved, much to the injury of the display of cheese, this necessary precaution against extreme heat was left out of the annexes where cheese was to be shown. Though no positive injury necessarily resulted to the cheese placed in them from this omission, yet in the hottest part of the summer the temperature in these rooms could not, without refrigeration, be prevented from becoming too high to allow of keeping cheese in them more than a short time without hurrying them to premature ripeness, and to a depreciation of value.

The danger and cost of transporting cheese in small quantities over long distances by rail, and of carting it to and from the Dairy Building were too great for dairymen to afford to make the frequent relays of cheese necessary to keep a continual show. This defect worked a double disadvantage. It gave the croakers—always too abundant in every public enterprise—a handle for discouraging exhibits, and they used it freely and effectually, and the result was, the cheese display room for the United States was nearly empty during the months of July and August.

The display of butter met with a similar misfortune. At the opening

of the special display in the last days of June, the authorities having immediate charge of this department, omitted to make a requisition for ice till the moment it was wanted. The extremely hot weather which occurred just at that time, so increased the consumption of ice that the supply department failed to meet the full demands of the enlarged orders, and the butter room had to wait its turn, and some eight or ten days elapsed before the order for ice for the butter room was responded to, and in consequence the butter had to be exhibited and examined in an unfavorable condition and hurried out of the building to prevent further injury. The uncertainty of proper care for their goods so discouraged exhibitors that no more butter was brought forward till cool weather in the fall.

In other respects the house was well built, better indeed than most of the factories through the country in which cheese is kept in hot weather. It was two stories high, neatly clapboarded and painted outside, and lathed and plastered inside, with casings painted and floors laid with matched stuff. The walls and partitions enclosing the display rooms were so liberally glazed as to give an almost unobstructed view of the goods on exhibition, without exposing them to the interference of visitors or to the contaminating influence of the outside air. A hall eight feet wide on the west side protected visitors from the weather and the rooms within from the heat of the sun. For all other sides there was a similar protection from verandas. A part of the upper story was occupied with rooms for officers and committees ; a part with a cheap lunch room for dairymen and others, which proved to be a much needed and valuable auxiliary ; leaving about one third of the upper part without any special use.

This building was designed to contain all the dairy products which should be offered for exhibition, but it did not receive them all. It was not ready for use till about the middle of June, when most of the foreign exhibits had arrived and found the best location they could in Agricultural Hall or elsewhere, and were not afterward moved to the Dairy Building. The dairy department, like every other department in the great show has had its friends, its earnest and active supporters, its troubles and its defamers. In whatever light different parties may view it from their different standpoints, it has proved a creditable and successful exhibition of dairy products, as will be apparent from the following summary of its exhibits :

The display of products connected with the dairy which were submitted to the Judges of Group IV for examination comprised Butter, Cheese, Condensed and Preserved Milk, Butter Coloring, Cheese Coloring, Preserved Rennets and Rennet Extracts.

Of Butter there were shown a total of 291 packages, having a total weight of 9,150 pounds. Of this number there were from the United States 226 packages, weighing 7,051 pounds ; from Canada, 23 packages, weighing 1,749 pounds ; from other countries, 42 packages, estimated at 350 pounds. This amount was presented in 149 exhibits, of which 123 were from the United States, 16 from Canada, and 10 from other foreign nations, including Portugal, Argentine Republic, Brazil, the Netherlands, Germany, Italy and Denmark.

Butter was furnished by the different States as follows :—New York,

48 exhibits; Iowa, 29; Wisconsin, 18; Pennsylvania, 16; Illinois, 7; Ohio, 2; Vermont, 2; Massachusetts, 1. There were 31 awards for exhibitions of butter recommended by the Committee with which I was connected; 22 for exhibits from the United States; 5 for Canada; one each for Portugal, the Netherlands, Germany and Denmark. Awards in the several States were as follows:—in New York, Wisconsin and Illinois, each, five; Pennsylvania and Iowa each three; Massachusetts, one.

CHEESE.

The display of cheese was much larger than that of butter. From the statistics at my command it appears that there were exhibited at the Dairy Building and on the grounds 2,086 packages of cheese, weighing 55½ tons, which were presented in 411 exhibits.

There were from the United States 1,018 packages, weighing over 26 tons; from Canada, 1,003 packages, weighing over 29 tons; from other countries, 65 packages, estimated at 500 pounds. These were from Portugal, Argentine Republic, the Netherlands, Brazil, Victoria, Italy, Norway, Turkey, France and England. Cheese was offered from the different States as follows:—New York, 627 packages; Wisconsin, 284; Pennsylvania, 55; Ohio, 48; Connecticut, 4. The cheese from foreign countries were generally of small size, and embraced samples of Stilton, Rocquefort, Edams, Switzer Case, and small cheeses from the milk of goats and ewes. Several of these were very distinctly affected with a flavor and odor resembling the perspiration of those animals, shewing that the existence of what is known as "animal odor" is not confined to the milk of the cow. Some of these cheeses from the milk of goats and ewes were made as far back as 1872 and were still in an excellent state of preservation, rich, clean flavored and palatable. Samples from Portugal were presented made in all the years from 1872 to 1875, inclusive, some of which were well preserved and fine, others badly depreciated.

Cheese from the United States and Canada were mostly the product of factories. Few of dairy make were shown from either country. Over 100 awards were recommended for exhibits of cheese. Of these, 45 were for the United States, and were distributed among the States in the following order:—To New York, 21; Wisconsin, 20; Pennsylvania, 3; Ohio, 1. The recommendations for Canada were 49, and the rest for other countries.

METHOD OF JUDGING BUTTER AND CHEESE.

In the usual course pursued at county and state fairs of "lumping" at the merit of samples without any analysis or precise record of qualities, and carrying the degree of merit in the mind of the inspector from one to another through a long series of samples, confusion and difficulty have often resulted, and the effort to secure even an approximation to accuracy been a tedious work, especially where the goods were to be classed into several grades. An anticipation of this difficulty having been several times expressed, and the query often raised as to how the judges could, with any sort of accuracy, distinguish between such a large number of samples so very nearly alike, not only in appearance but in actual merit, as were those presented to the International judges for examination, a brief statement of the method of judging adopted by which all confusion and inaccuracy were avoided, and the labor of the judges greatly facilitated

seems appropriate. At the suggestion of the Chief of the Agricultural Bureau, a scale of points was prepared for both butter and cheese, to be rated by numbers, the sum of whose numerical values should, in each case be 100, when the goods were in all respects perfect.

These scales were each divided into six points, and a numerical value given to each, according to its relative value in making up the sum total of a perfect sample. To make it easy for the judge the several points were arranged in order, and a definition of the items which were most prominent in making up the positive qualities was placed after each point and followed by a definition of the chief negative qualities which enter into defective samples.

Strictly speaking, two points cover all there is to either butter or cheese. One of them consists of the peculiarities derived from the milk; the other depends on make. But for greater distinctness and facility in estimating their most prominent and clearly recognized features were divided into six points.

Those scales of points with their positive and negative definitions are as follows:

SCALE OF POINTS FOR JUDGING BUTTER ON A BASIS OF A TOTAL OF 100 AS PERFECTION.

DEFINITION OF POSITIVE QUALITIES.	DEFINITION OF NEGATIVE QUALITIES.
Flavor 25.—Agreeable, clean, nutty, aromatic, sweet, pure, distinct and full.	Strong, rancid, tallowy, cheesy, bitter, stale, insipid, too salt, too fresh.
Keeping 20.—Inclined to slow changing, indicative of stability in retaining good qualities.	Early loss of good qualities and assumption of bad ones, indicating rapid change.
Solidity 10.—Stiffness of body, firmness, not easily melting or becoming soft.	Softness of body, unable to stand firm, easily melting or becoming soft.
Texture 15.—Compactness, closeness of grain, breaking with a distinct fracture like cast iron, fat globules, unbroken and perfect, sticking little to trier.	Openness of grain, salvy, greasy, sticking to trier or knife in cutting, pasty, not breaking with distinct fracture.
Color 15.—Pleasing, natural, not appearing artificial, bright, even.	Excessively deep or pale, appearing artificial, dull, uneven.
Make 15.—Includes all not included under other points, as cleanliness, perfect separation of buttermilk, proper handling of milk and butter, as churning, working, salting, skilful packing, etc.	Uncleanliness, imperfect churning, or at bad temperature, uneven working, salting, bad or mussy handling, packing or moulding, etc.

In accordance with above scale, Judges will place opposite the points

respectively, such numbers as will, in their judgment, indicate the merits of the particular butter under examination.

Perfection.	No. in Catalogue,									
	No. Examined,									
25	Flavor,									
20	Keeping,									
10	Solidity,									
15	Texture,									
15	Color,									
15	Make,									
100	Totals,									

SCALE OF POINTS FOR JUDGING CHEESE ON A BASIS OF A TOTAL OF 100 AS PERFECTION.

	DEFINITION OF POSITIVE QUALITIES.	DEFINITION OF NEGATIVE QUALITIES.
Flavor 25.	Agreeable, nutty, buttery, fine and full.	Off flavor, strong, tainted, sour, bitter, rancid, vapid.
Keeping 15.	Preservation, inclination to slow changing, retention of good qualities.	Rapid decay, early loss of good qualities, soon taking on bad ones, inclined to rapid changing.
Quality 20.	Mellow, salvy, pasty, flaky, stoky, rich, soluble, melting on the tongue.	Tough, leathery, curdy, sticky, dry, crumbly, insoluble, not melting on the tongue.
Texture 15.	Solid, close, firm, compact.	Porous, spongy, loose, weak.
Color 10.	Pleasing, natural; not appearing artificial, even.	Excessively deep or pale, unnatural, uneven.
Make 15.	Includes all not included under other points, as use of rennet, proper manipulation, ripening curd, salting, pressing, curing, perfect rind, cleanliness, etc.	Improper use of rennet, uneven heating handling and ripening curd, bad salting, curing, imperfect rind, cracks, skippers, uncleanliness, etc.

In accordance with above scales, Judges will place opposite the points respectively, such numbers as will, in their judgment indicate the merits of the particular cheese under examination.

Perfection.	No. in Catalogue.									
	No. Examined.									
25	Flavor,									
15	Keeping,									
20	Quality,									
15	Texture,									
10	Color,									
15	Make,									
100	Totals,									

A comparison of results shows at a glance the per cent. of perfection and comparative merits of each sample, according to the judgment of the examiner. But it was not found necessary to go through this formality

with every sample. After a little experience the operator was able to estimate the per cent. of perfection with much exactness and to set it down at once. This was done with a short description of the exhibit following the catalogue number, thus, in the examination of butter:—No. 275. One Firkin, June make—Fine, nutty flavor, well preserved, pretty salt, bottom slightly changed from contact with wood—90. No. 314.—Three 55lb Pails, best yet seen—100. These descriptions and numbers following the catalogue number, enabled us, by looking over our minutes, to know exactly what opinion we had formed from the examination of each exhibit, and saved the operator the necessity of carrying qualities in his mind. Where very close discrimination were required, the packages rated the highest—those which would stand any chance in the competition—were re-examined. Thus, when special prizes were to be awarded, as in the United States butter and Canadian cheese, the best exhibits, as shown by our notes, were re-examined the next day in the morning, while we were fresh and our tastes in the best condition. In this way any error or misjudgment which might occur from fatigue or confusion of taste, was readily corrected. But it was very rare that our first impressions were changed by these second examinations.

The exhibits were known only by their numbers, and ownership and place of production were kept out of sight as far as possible, the judges desiring to follow absolutely nothing but the quality of exhibits in making their awards. From first to last they have constantly aimed at fairness and accuracy. If they have made mistakes they have done nothing more than those who have preceded them in such labors, but they console themselves with the consciousness that they have done right, and flatter themselves that in no department of the great Centennial show have awards been more carefully or justly made than in the Dairy department.

The few samples of condensed and preserved milk were examined with much interest, as they afforded evidence of the triumph of art and science in counteracting successfully the perishable tendency of milk in its natural condition, and giving to it both as a luxury and a necessity a broader use in the dietaries of nations. The specimens shown were of various ages but all in a high state of preservation, sweet and palatable, and in every way suitable for food, the natural properties of the milk being unchanged.

According to a paper by Prof. E. N. Horsford, of Cambridge, Mass., read at the recent meeting of the American Dairymen's Association in Judges' Hall, and which will appear in the twelfth annual report of this Association, it is just a half century since the efforts of condensing and preserving milk in the mode now in use began. The following salient points in the history of its progress are gathered from the paper referred to, and may be of some interest in this connection as shewing how the struggle for accomplishing this important purpose has progressed: The work commenced with A. A. Malbec, of Paris, in 1826, who condensed milk by the means of a water bath and preserved the product by adding sugar. Four years later Braconnet preserved the casein of milk after separating it from the whey, and prepared it for use in a liquid form as a substitute for milk.

In 1835 Wm. Newton patented a process in England for the condens-

ation of milk in vacuo and by currents of air passing rapidly over the milk, but was unsuccessful by either method, as is apparent from the kind of patents which followed. He used sugar to preserve the condensed product. As late as 1847, a patent was taken out in France for the condensation of milk in shallow vessels over a water bath, by constant stirring and adding sugar. In none of these processes was the proportion of sugar definite. In 1849 Prof. E. N. Horsford, of Massachusetts, determined in his laboratory the precise proportion of sugar necessary to a perfect preservation, and the necessity of a lower temperature while evaporating the water than had been before used. These were only developed as scientific formulas, but were of great practical use afterward. He turned over his advance to his assistant, Mr. Dalston, who took out a patent in the U. S. for further improvements in 1854. He made some progress toward giving to preserved milk a commercial importance. In connection with the Messrs. Blotchford & Co., of New York, he prepared in 1856, 600 pounds of dry, solid milk for the exploring expedition of Dr. Kane which sailed in that year. A sample of this dry solid milk furnished for Dr. Kane, preserved by loosely wrapping in paper, was shown to the judges, and at the meeting of the American Dairymen's Association on the Centennial Grounds, and although twenty years old, was sound and sweet. Gail Bordin, of New York, took out a patent in 1856 for the condensation of milk in vacuo without the addition of sugar, which was sold for immediate use. Afterwards he added sugar and preserved the condensed milk for long keeping by sealing it up in air tight tin boxes. Mr. Bordin used the process of Newton but made a much more skilful use of the developments which had been made than any of his predecessors, as he was the first to make a commercial success of the condensation and preservation of milk. No important advance has been made since the time of Bordin, his modes of working being now in general use both in this country and Europe. One more advance in this art is still much needed to cheapen the product and give it greater utility. I allude to the necessity of some mode by which it can be condensed in smaller quantities without increasing the cost. In view of the great value of milk as an article of food, its perfect nutrition, its wholesome qualities, and its agreeable flavor, any means which would aid in giving it a more extended use must prove to be of great value not only to dairymen but to the general public. But with the present means in use, preserved milk now forms a considerable item in the dairy interest both in Europe and America.

The samples of cheese coloring and preserved rennets presented nothing new. I can simply say of them that some very fine samples of both were exhibited by your enterprising citizen, Mr. E. Casswell, and that they were recommended to the commission for awards.

In butter coloring a product was presented which was new to the judges but which we have since learned has been introduced to the butter makers of the country by Messrs. Whitman & Burrel, of Little Falls, N.Y. I allude to preparing the extract of annatto in oil, by which means the alkaline effect of the old preparation is obviated. The examinations of butter during the summer have made apparent a fact of which we had not before been convinced, that the alkali employed for dissolving annatto or annattoine though very small, produced an effect upon the grain of butter

and upon its keeping quality. The preparation of coloring in oil is commended to the attention of Dairymen.

Two samples of rennet extract were presented from Copenhagen, Denmark, one of which was worthy of attention. It contained only the active agency of the rennet in a very concentrated form, so that one pound of the liquid would coagulate 10,000 pounds of milk at the usual temperature at which rennet is applied to milk. A second advantage it possessed was perfect uniformity in strength. This is practically important to the manufacturer. The varying strength of different soakings of rennets often stands in the way of best results, and is always annoying. But the feature in the extract which made the most favorable impression, was its entire freedom from odor and flavor. The mucilageous and other animal matter which steeps out of the rennet skins and goes into the cheese often produces strongly modifying effect upon the flavor of the resulting cheese, and always operates to its injury, and to the injury of its keeping quality also. The strong, not to say offensive, odor of steeped rennet is always a noisome product to a tidy dairyman and often interferes materially with the fine flavor of his cheese. All this is entirely wiped out in the Danish extract. It contains nothing that can in the least modify or warp the pure flavor cheese derives from sweet milk. The art of making this valuable extract is kept a profound secret with the inventor, and its use is confined to the narrow limits his works can supply, and is not in use that I am aware of on this side of the Atlantic. Appreciating the great utility of such products in this country, I have applied myself to the task, and in connection with Prof. Caldwell, of Cornell University, have succeeded in producing an extract of rennet in every way equal to the Danish extract and at very small cost. It will be offered to the dairymen of the United States and Canada in the spring.

INFERENCES AND LESSONS FROM THE CENTENNIAL DAIRY SHOW.

The annual production of butter in the United States is now about 710,000,000 lbs., of which the fraction exhibited at Philadelphia was but a hundred thousandth part. Yet small as it is, it is larger in proportion to the amount produced than the exhibits of any other agricultural product from the States, unless, perhaps, we except tobacco. Since the per cent. exhibited is in excess of the average of other agricultural products shown by the United States, the show even of butter, which was in much smaller quantity than cheese, will not, so far as quantity is concerned, be regarded as a failure by any fair-minded man. None but inveterate croakers will so deny it.

The quality of butter shewn has given a good indication of the progress which is being made in its manufacture, and has afforded some valuable lessons. I will only allude to one or two. With the exception of Canada, the butter from foreign countries came to us from long distances. It was necessarily made a long time in advance of its exhibition and its test by the judges. The greater part of it was unsalted, and to such as received salt at all it was applied very sparingly. Yet some of these samples were in a fine state of preservation and not at all rancid. One of the samples from Denmark had been exhibited at the Vienna Exposition in 1873, and was still sweet and little changed, while packages of recent make from our country and highly salted to preserve them, were hurrying to destruction in a few short weeks. The long keeping of the

fresh butter seems to prove that *salt does not preserve butter*, but that keeping quality in butter depends more on *make* than on *salt*.

A large share, I do not know exactly how much, of the butter of the United States, which finds its way to the large markets, is now made in factories and creameries. The product of these establishments, while they have always offered to the dealer the advantages of large quantities and evenness of quality for which he could afford to pay a premium over dairy made butter, never uniform and always expensive to collect, have all along been regarded, and justly too, as inferior to the best dairy make both in flavor and keeping. At both the June and October displays, the most perfect flavor and the indications of the longest keeping quality were found in the butter of factory make. The samples of butter presented at this show have thus evidenced an important advance in this branch of the dairy interest.

I may mention the butter from the factories of Messrs. John Stewart & Co., of Manchester, Iowa, as a model product of its kind. Considering the large amount exhibited—64 packages made at different times and at seven different factories and every one excellent—they are entitled to great credit for the superior quality of goods they have shewn. Nine packages of similar excellence—the products of two creameries—were shown by Messrs. Gooch & Barber, of Chicago, Ill.

The peculiarities of factory cheese were well delineated in the exhibits of both United States and Canada. In the June display there appeared samples of fine cheese made from the milk of cows fed, some on hay, and others on grass, demonstrating that it is possible, even under what are usually considered adverse circumstances, to produce goods of high quality. But the great bulk of "hay cheese," as it is called, was not particularly fine. That shown in August and September was much off flavor, the milk of which it was made having been affected by excessive heat. Not more than 25 per cent. of these exhibits were strictly fine, but that small fraction proved the possibility of making first-class cheese all the season, if first-class skill was employed in producing and manipulating the milk.

The cheese exhibits from both countries in the October display were generally fine, and attested the superior excellence to which the factory system is capable of reaching. Finer samples of cheese I have nowhere met with than appeared among them, some of them being absolutely faultless. Those which were the very choicest, had, so far as I could trace, one peculiar feature in their manufacture. Those in which the flavor was the most pure and nutty, and which appeared the richest and most meaty had the whey removed from the curd at the earliest period in manufacturing. This is the essential point in what is styled the cheddar process—and it is one which our dairymen must adopt if they would have the richest and cleanest flavored cheese. The cheese shown by the United States was not very uniform in quality, some of it being of great excellence, and some quite ordinary.

The cheese of the highest order was confined to no particular locality though New York State took the lead in the proportion of such cheese shown by the States. Among the best cheese from the United States were samples from the factory of Dr. L. L. Wight, of Whitesboro, N. Y.; E. C. Rice, Fairfield, N. Y.; G. W. Davis, Little Falls, N. Y.; M. N. Seward, Lake Mills, Jefferson County, Wis.; and J. G. Holman, Con-

nantville, Crawford County, Penn. All of which were alike graded at 95 per cent. of perfection. The best exhibit from the United States was shown by C. W. Richardson. of Herkimer, Herkimer County, N. Y., and was graded at 96 per cent.

The factory cheese from Canada was also quite uneven. Some of it ran very low and some very high, making the extremes even further apart than in the cheese from the States, but its average was higher. From what I have learned the past season of Canadian manufacture, I think the cheddar system is practiced more with you than with us, and this, I suspect is one of the points to which the superiority of your cheese is to be ascribed. The cheese presented in October by Thomas Ballantyne, M. P. P.,of Stratford, in which this peculiarity of make was most successfully carried out, was the finest cheese shown during the Exhibition, and was graded at 100. To it was awarded the sweepstake prize for best Canadian cheese. There were twc other exhibits in October, those of Mr. D. Chalmers and Alex. McKenzie, which differed but little from the best.

The per cent. of perfection in the October exhibits of cheese from the individual States and United States collectively, and Canada collectively were as follows :—Connecticut, 50.00 ; Ohio, 60.00 ; Wisconsin, 76.00 ; United States, 76.82 ; New York, 79.05 ; Pennsylvania, 83.22 ; Canada, 87.36.

DISCUSSION.

Question—What is the best method of cleansing butter packages ?

Prof. Arnold—Soak first in cold brine and then in boiling hot brine, cover and keep it hot as long as it will. In this way the flavor of the wood will be entirely removed. We found a great deal of the competing butter injured by improperly cleansed packages.

Ques.—What sized packages would you recommend ?

Ans.—That must depend upon the market.

Ques.—What kind of salt do you recommend ?

Ans.—Any pure salt. I conclude there is nothing better than Ashton salt, when pure, but Onondaga salt is most reliable because it is least counterfeited.

Ques.—What quantity of salt do you think is necessary ?

Ans.—The smallest quantity that will satisfy the taste of the consumer. The people along the sea coast require butter a little salter than those living inland.

Mr. Lewis—I congratulate the Canadians on their success, but would have been a little better pleased had they allowed old Herkimer county cheese to get a little ahead of them (laughter and applause). I don't believe that Canadian dairymen will ever feel any better than they do just now. (Applause.)

Question—What about the sub-earth duct at the Centennial ?

Prof. Arnold—There was a sub-earth duct put in for the Dairy building which proved a complete failure, for which I am willing to confess I was, with others, at fault. It was improperly put in. The duct was too large. It admitted more air than could be cooled by its walls, and then it was covered with boards—a non-conductor—instead of stone. The principle involved—making a passage under ground to cool air passing through it before entering the room to be cooled—is sound and will work well when properly constructed.

Mr. Casswell—Did any of you notice an article in the papers from one Mr. Oliver, an Englishman, who asserted that there was a "dairy ring" at the Centennial, and that in consequence there were very few exhibitors and therefore no competition?

Mr. Lewis—This Mr. Oliver knows about as much about that as he does about making cheese. He came over here professing to know all about cheese manufacture, and offered to enlighten our factorymen on the subject, but in every case signally failed. That sub-earth duct I consider a dead duck. (Laughter.) It is perfectly worthless in my opinion. Its inventor, Mr. Wilkinson, was one of those who encouraged the charge of the dairy ring, being disappointed because the Executive Committee of the American Dairymen's Association refused to incur an expense of $7,500 in testing it. Among other disappointed aspirants who joined in the cry were Mr. Reall, X. A. Willard, and O. S. Bliss, who felt aggrieved because they were not appointed judges, or to some other position. There is not a particle of truth in the statement that there was a "dairy ring," nor the slightest foundation for such an accusation.

Prof. Arnold—I will give an instance or two, to illustrate Mr. Oliver's skill in cheese manufacture. He went to one of the best factories in Herkimer County—that of Mr. Harry Burrell, near Little Falls—and undertook to instruct the workmen in making cheddar cheese, where he succeeded in reducing the value about one half. In the factory of Dr. L. L. Wight, of Whitesboro, he was also successful in injuring all the cheese he made. At Fink's Basin—a creamery in which skim cheese is made after after taking all the cream they can get from the milk—I saw some of his whole milk cheddar cheese, which were inferior to the skims, and a few days ago, I was informed by one of the proprietors of the creamery that the last one Mr. Oliver's cheese had been disposed of by burying. I was glad to hear Mr. Lewis' denial of those charges concerning the dairy ring, and his explanation of the conduct of those making them. It was very inconsistent in the gentlemen referred to, and others who acted with them, to do all they could, publicly and privately, to discourage exhibitors from taking part in the exhibition by advising them to keep their goods at home, and in the next breath blame the committee because the show of dairy goods was not more successful. But while I was glad to hear his emphatic statements on this subject, I must say I think my friend Lewis expressed himself a little too strongly in regard to the practical value of the sub-earth duct. Mr. Bois says it has operated to his satisfaction, cooling the air when too warm and warming it when too cold, and he certainly ought to know as he has one in constant use.

As the discussion closed a unanimous vote of thanks to Mr. Arnold for his excellent address on the Dairy at the Centennial was moved by Mr. Hamilton and passed.

Prof. Arnold—I am very grateful indeed for this expression of your approbation. It gives me great pleasure to know that my labors are appreciated by this intelligent audience.

SECOND DAY.

The Convention resumed at 10 o'clock a.m. Vice-President D. H. Burrill, of Little Falls, N. Y., took the chair, who introduced Mr. C. L. Sheldon, of Lowville, N. Y., who delivered an address on "Leaks in the Dairy." By the request of the chairman, Mr. Sheldon gave a brief

account of the great difficulties he and others had met with in reaching Ingersoll, owing to the heavy snowstorm in N. Y., and consequent blocking up of the railways. Such was the immense blockade of snow, that as many as five and even seven engines were necessary, and then not without considerable delay.

LEAKS IN THE DAIRY.

Mr. President, Ladies and Gentlemen,—In appearing before you to discuss a theme that has claimed the attention of dairymen for years, we are reminded that a path so well trodden has little to attract by its novelty; that the sober concerns of every day life, and the felt wants of the industrious portion of the community at least must be relied upon to give interest to what we are about to say.

When dairy products were commanding in the markets double present prices, the need for economy was not as apparent as now, and a request to stop up the leaks, would not have been as well heeded then as now.

The lessons of the past season we trust have been potent in this direction; and many a dairyman has come to the conclusion, that for him there exists the necessity to stop the most trifling leak, for fear that the dairy ship will sink. We were about to say (and also work diligently at the pumps), but we fear this advice would be heeded in a wrong direction, in which it would do more to sink than to save the craft.

A great diversity of opinion may prevail as to what are really leaks. For instance, should our friend Harris Lewis be passing by a herd of cows feeding upon corn fodder, he would look about, and if he came to the conclusion that the soil was adapted to grass he would exclaim, "What wastefulness!" Again, should our friend Prof. Arnold be invited to dine with us, and should the butter or cheese be the product of rare or peculiar circumstances, he would think, "How wasteful to eat that which, if subjected to the microscopic examination or chemical analysis would advance the interests of dairy science." If our friend L. T. Howley were to step into our dairy rooms, and find us seasoning our dairy products with cheap common salt, he would think, "What poor economy; run the risk of spoiling all you produce with impure salt, when you could have our warranted 'Factory Filled.'" And so different individuals from different standpoints or different experiences, judge differently, and what might be termed true economy by one, would be called downright wastefulness by another.

Our standard of measurement is the product of our personal experience, and is not designed to measure the deep and intricate parts of the subject but those simple things that are continually before us. With this standard we will measure, 1st, As to the production. If the price of the product is low, we must produce more to sell or content ourselves with less money.

For the past five years the dairies coming to my factory have produced on an average per cow from 2,329 lbs. to 2,650 lbs. milk. This during the cheese making season averaging about five months. For the past year the best dairy produced 2,923 lbs. per cow, and the poorest 1,832 lbs. per cow; or 18 lbs. per cow each day for the best, and not quite 12 lbs. per day for the poorest—33 per cent. in favor of the best. If there is but a fair profit with the best dairy, it would need a microscope of high power to show the profits of the poorer dairy; but not such an in-

strument to reveal the leak; they are very apparent. The ancient dreamer of Egypt well describes them when he says: "Poor and very ill favored and lean fleshed." If we seek the cause we will generally find poor and insufficient food and sometimes the same in reference to the water.

Pastures that are just capable of feeding our stock in the flush of feed, will be insufficient at all other times. If, on the contrary, during the flush of feed they produce more than the stock can consume, it will soon beome hard and indigestible; poorly fitted to produce milk. If we would stop this leak, we must make some provision for a constant supply of milk producing food. What that food shall be is not as important as that there be a constant supply. Fodder, corn, rye, oats, clover or timothy, anything is far preferable to nothing. But that there should be some supply we regard as an axiom in true dairy science. Says one, who tries fooder corn for a supplementary food, "My cows do not gain in their milk; I see no use in the fodder." That the cows should gain in their milk is not as important as that they should not shrink, and a food that keeps the supply constant, and cows in good flesh, will pay in the long run. This keeping up the milk product is important from another consideration; that is, a larger percentage to sell when the market value is highest.

In a climate like ours the cow must not only be well fed, but well housed. The neat and commodious barns that are springing up all over the country, attest that this point is receiving attention. Among our earlier experiences our recollections of detached, single boarded barns, shivering cows, hay mows six to eight inches under snow on mornings after a blustering night. In cleaning stables an axe called into requisition nearly as much as the shovel. Added to this the fodder giving out before the winter had passed, and hay to buy and haul (and by the way this made a big leak in the dairy). Before I became of age the responsible duties of the farm devolved upon me. One of our first efforts was to tear down these small barns and build a larger and more comfortable one. For twenty years the farm has carried some 25 per cent. more stock than formerly, and we do not recollect of a single outlay for fodder. In this saving the barn was an important factor. Fodder is an expensive fuel. The effect of temperature is well illustrated in the *American Cultivator*. It says: "The food daily consumed by a Greenlander would serve an African for weeks. The Esquimaux consumes in twenty-four hours two gallons of whale oil, besides large quantities of other fatty substances, while a handful of dates and a little fruit will answer the Arab's daily wants. Capt. Perry, of Arctic fame, weighed and presented to an Esquimaux lad at one time, 18 ounces frozen sea-horse flesh, 66 ounces wild sea-horse flesh, 28 ounces bread and bread dust, 20 ounces rich gravy soup, 160 ounces water, 1 tumbler grog, and 3 wine glasses raw spirits. This large quantity of food, which the lad did not consider excessive, was consumed by him within 24 hours." Other instances are mentioned. In view of this it is the dictate of prudence to stop up the cracks in the stable; they are leaks in the dairythat need attention; but as you stop them do not neglect the needed ventilation. With these leaks stopped, your cow well fed and well housed, you sit down to milk her. She swings her tail at an annoying fly and

accidentally hits you in the face ; you wish to have her well behaved, so you get up and instruct her ; you pat her with the toe of your boot ; you soothe her with the edge of your stool ; you talk to her with all the earnestness you can command. Again you sit down to milk her ; her foot itches this time ; she raises it ; you try to stop it ; it itches badly and must come up ; you and the pail are in the line of its movement ; you get out of the way by siding over on the floor ; the pail and its contents follow you ; a kind of providential provision for heated, feverish systems. You get up and repeat these lessons till you get the cow so well learned that she is able to go through with the manœuvres at nearly every milking. You finally conclude that she was not constitutionally adapted to milk, so you sell her to the butcher assuring him that if she is not tender steak you do not know how to make it. If the Creator had designed to have cows kicked and mauled he would have put a coat of armour upon the places wont to receive such treatment ; perhaps something like the shell of the tortoise, upon which the brutal might kick and pound to their heart's content. As she has no such shell don't pound her ; every blow you strike makes a leak in your dairy. 'Tis too expensive ; you cannot afford it. Mr. Lewis has well said, " there is no place in God's creation for a brutal man." We do not expect to reach his ear here ; such men do not attend these conventions. But you may have such men in your employ, and as you value your interests here or in the great hereafter, don't let them abuse your cows. If I was an artist I'll tell you what kind of a picture I would paint. I would have a herd of cows seeking shelter from a burning sun, beneath the shade of a pleasant grove ; I would have a hired man in a hurry to go out somewhere come among them ; I would have him start them into a run, and follow them at his quickest pace until he catches the hindmost by the tail ; I would have him run them until, exhausted, the cow with the extra load falls and is unable to rise. Then I would paint a cheese factory in one corner of the scene ; I would have the operatives working over a tainted curd. At the opposite corner I would have a dwelling with the family sitting down to tea ; the milk is put into the tea ; it tastes strangely, it smells strangely ; it smells like the vat of tainted curd. This is my picture. If there is an artist here to paint it, let him make the house and family like my house and family ; the factory and operatives like my factory and operatives, and the hired man like one once in my employ, and let him entitle the picture "The great leak in the dairy." Let this be hung in every dairy barn, and bind it a companion picture of a phantom cow with tail outstretched toward the palm of the hired man in the other picture, and let this phantom cow follow him through all the hot days of life, and the hotter days of the hereafter. Entitle this piece " Retributive Justice."

We have spoken of the milk product as influenced by food, shelter and care. With the worst leaks stopped in this direction so that the dairymen delivers to the manufacturer a large quantity of pure, wholesome, milk, we have next to do with the manufacturer and manufactured product. As in the former part of our subject we will touch upon but a few points, where the dear school of experience has taught us important lessons. The leaks here must be corked by skilled manufacturers, palatable products, people who relish such products, and cash that pays for them.

If we should visit a friend in early autumn and he should treat us with hard winter apples, we would think him extremely wasteful and short-sighted, to say the least. If we go to the grocer and ask for cheese, we are often impressed with the belief that the same mistake is made. Several years ago we re-shipped from New York for a grocer a few what we thought fine cheese ; they were cut and dealt out to customers after the usual manner ; passing in and out and tasting of them occasionally we were impressed with their unlikeness to the original samples, especially so the longer the cheese had been cut. This was exactly opposite our experience with cut cheese at home, the last pieces almost invariably being the best, (we keep in the cellar) the grocer in a warm dry room, the cheese continually shrinking in weight, and faster still in quality. The problem of successful cheese dairying in the years to come must be solved by the consumer. If for any cause the foreign demand ceases we fear the leak would sink the dairy ship. Race characteristics, as Artemus Ward said, one year ago may have much to do with the food consumed. Whether these race characteristics are inherent or not may be questioned. Our bill of fare is very different from our grandfather's, and we think education and habit have exerted a controlling influence in this change. That the American people are not a cheese eating people may be due mainly to two considerations : 1st. They regard cheese as a luxury, not a cheap and wholesome article of food, as it is proved to be. 2nd. Their experience of purchasing from grocers has been different from what it need or should be. In producing a correct public sentiment regarding the first point, this Association is entitled to the thanks of every dairyman ; but this lesson will be but poorly learned if dairymen do not take the lead. Upon this point we have a few statistics to offer. In 1872 my patrons took 1,904 lbs. of cheese ; the general average price for the season was 12 86-100 cents per lb. In 1873 they took 1,645 lbs. ; average price, 13 13-100 cts. In 1874 they took 1,570 lbs. ; average price, 13 30-100 cts. In 1875 they took 2,201 lbs. ; average price, 11 43-100 cts. In 1876 they took 2,221 lbs. ; average price 11 4-100 cts. For the 1st four years the families represented by the patrons would number 200 persons. The smallest average amount consumed per individual during those years is nearly 8 lbs. ; the largest average during any of those years 11 lbs. The smallest amount when the price was highest ; the largest amount when price was lowest. The past year the average consumption per head is 14 lbs. ; the average price 11 4-100, the lowest of any of the five seasons. From this we conclude that dairymen consume most cheese when they consider it cheap, and that the lowest average consumption if applied to the whole country would leave us independent of a foreign market. In my own family we use 30 lbs. per head,and a merchant of our place, whom I supply, about the same. Other patrons consume as low as four pounds per head, this low amount we are persuaded, not because they dislike cheese, but because they do not regard it as true economy to eat it. In my factory there are three cows to each person. If we take the difference between the maximum and minimum consumption of cheese by different families and apply it to the dairymen represented by one million cows employed in the cheese manufacture, we would have an increased consumption of nearly nine million pounds. If the maximum of individual families is compared to the general average of the patrons for

five years, and the difference of 20 lbs. per individual applied to the dairymen represented by the million cows, the consumption would be increased nearly seven million pounds. Is it not reasonable to suppose that the shortening of the cheese crop seven million pounds would raise the price one cent? The family of ten persons who eat four pounds a-piece at eleven cents per pound spend $4.40 for their year's cheese. If they ate 30 pounds a-piece they would reckon that all spent above the $4.40 was so much lost, and would figure up that they were $28.60 out of pocket. But with the thirty cows which they represent yielding 250 lbs. cheese each, they would, with the one cent advance in price, pay for the larger amount consumed, and have $39.00 more money than in the first instance. In this instance we give no credit to the cheese as a food, or of the example of the dairyman to induce others to use it. For the cheese dairyman to consume cheese as freely as any other food he likes, is the dictate of true economy. The greatest consumption and most satisfactory prices, imply best skill in manufacture, right appliances for curing and cutting at maturity. Well made cheese is often damaged by imperfect curing. This is a leak that tells especially on late made cheese. One year ago we held our Sept. and Oct. cheese, (we stopped making the 22nd of Oct.) We sold in February to an agent of Fowler Brothers; this agent was instructed to pay 13¼c. for September, and 12¾c. for the October make. As it was the best we could do we accepted the offer, but protested against the distinction, assuring the agent that as far as our own judgment was concerned, the October were fully up to the September in quality, if not ahead. To test the case still further, we sampled the early September and late October, and handed the samples to the agent to tell when made. The result was the September samples were called October, and the October samples were called September. These cheese were cured by the heat of a coal stove in a ceiled room. They were the first that we had cured in a room where we could keep the temperature as we desired, and they were better than any previous lot of October that we had made. Now, here was a leak of one-half cent per pound that we were subjected to, because the general make of October cheese was worth that less in the market. Here the important lesson was brought directly home to us, that if we had any better method or practice than our neighbor, it was for our interest to have him adopt it at once, or he would be dragging down the price of our better goods. This law runs through the whole cheese interest; so that the man who takes bad milk to the factory, the manufacturer that poorly makes or cures his cheese, not only brings down the price of their own product, but brings down everybody else's product. That is the tendency in this direction. So that in a certain sense every careless slovenly dairyman becomes a public curse.

A curing room where the temperature can be controlled so as to keep the cheese cool in hot weather, and warm in cold weather, is one of the great needs of the cheese manufacturer. Such unprecedented hot weather as we had last season demonstrated to our satisfaction that cheese could be carried through a hot period with but little deterioration to their quality. Also that to ship cheese from such a curing room to a distant market in an extreme hot atmosphere, was a disastrous undertaking, subjecting them to a temperature to which they had not been acclimated. Let consumers have our goods as fast as they are ready to consume them. To throw them

upon the market faster than this during the hottest period of the season, must bring down prices and load consumers with damaged cheese, making not only a leak in the price, but also in the demand.

The proper constructed curing room, and the giving of keeping qualities to our cheese will enable us to carry such portion of our goods as the wants of the market do not require, will enhance the average price and quality of our goods, and give us a position of independence which we could not otherwise have. But this great desideratum of proper curing rooms must be intelligently and properly managed; it will not do to keep them open during the extreme heat of the day, nor neglect to have a fire when the temperature falls below the proper curing point. Of this latter we were strongly reminded this fall. We had other work on our hands and did not give as close personal attention as formerly to the curing. Some days were warm enough, then for a while a little too cool. Finally the weather was so cool that a constant fire was kept. When we came to try those cheese in November, we found a clearly defined mark of quality; those cheese that were subjected to the lower and changing operation inclined toward bitterness; whereas those that had always been kept at the higher and more uniform temperature were of a sweet nutty flavor and mellow texture.

I have given you an account of some of the leaks in the dairy that have come under my observation; I have measured them with my own imperfect measure, and some of them I have tried to stop up in my practice. What commends itself to you, adopt. We are a common brotherhood engaged in a common calling; our interests are mutual; the propriety of one is the propriety of all. Our goodwill stops not at the line of the lakes and the St. Lawrence; it grasps in its warm embrace all who seek excellence and improvement in our chosen calling of the dairy, regardless of nationality.

Mr. Farrington, taking the platform, said: I have paid strict attention to Mr. Sheldon's paper, and I assure you it seemed to me so perfectly true in all respects, so right to the point, that I cannot criticise it at all. I can only move a hearty vote of thanks to Mr. Sheldon for his excellent address.

Prof. Arnold.—I have great pleasure in seconding that motion. While concurring in what Mr. Farrington has said, I would also say that when we can get Mr. Sheldon to speak, we never fail to hear something good. I cordially second the motion.—Motion carried.

Mr. Sheldon—I feel that I am under great obligation to this audience for this expression of satisfaction with my efforts to serve the cause of the dairy, and while I tender my thanks for this, your free will offering, I assure you I shall feel encouraged to carry out my resolution to continue to apply my feeble talents to the improvement of our common occupation.

DISCUSSION.

Mr. Ashley—What means do you use for ventilation and keeping an even temperature in your curing rooms?

Mr. Sheldon—I use scuttles which I can open from below for admitting the cool air, and also make use of the windows and doors for the same purpose. There is almost always, during the twenty-four hours, a time when the air outside is as cool as it should be in the curing room,

even during the hottest weather. It is then that I open the windows, doors, &c., and keep them closed up when very warm. My cheese is apt to mold by keeping it in a close curing room, during the heated term, but on the whole from my experience, I think it makes the best quality of cheese.

Prof. Arnold—Have you noticed any bad effects from curing cheese in close rooms, indicating a need of fresh air?

Mr. S.—So far as my observation goes on this point I have seen no deleterious effects from tight rooms, or necessity for fresh air.

Mr. Farrington—I would like to ask Mr. Arnold if hurtful gases should be exhaled from any of the cheese, if they could be re-absorbed or taken in by other cheese in the room to their injury?

Mr. A.—Gases have a law unto themselves by which they expand indefinitely and become equally distributed in any given space. A thimble full of gas let loose in a tight curing room would fill the room with its presence and have an attenuation according to the size of the room. Cheese not being impervious to gases, it would fill the space occupied by the cheese, as well as the space occupied by the air. Experiments made in Cornell University by putting green cheese under a perfectly tight bell-glass receiver indicated that in the earlier stages of curing the cheese gave off nothing but carbonic acid gas and water, and rapidly absorbed the oxygen from the air. In the later stages carbonic acid gas only was evolved. This gas, according to the law of the diffusion of gases, would penetrate the cheese as well as the open space in the room, but I should not anticipate any injury from its doing so. It is my observation that cheese cure faster and better in close rooms to which oxygen is not freely admitted. If the milk was perfect, and the cheese perfectly made, my inference is that they would be best and soonest cured in a close and also dark room. If the cheese are from any cause faulty, so that offensive gases are evolved, good ventilation becomes an absolute necessity to prevent re-absorption and injury to flavor.

Prof. Stewart—I was struck with the fine illustrations in Mr. Sheldon's paper, particularly to those which refer to the importance of kind treatment of cows. It reminds me of an incident. A city gentleman had two men in his employ, John and Charles, each of whom sometimes milked the cow. On a certain occasion a larger flow of milk was noticed than usual, and on enquiry it was found that Charles milked the cow then, and following up the inquiry as to the reason why Charles got more milk than John, it was found that when Charles went to milk her, he gently stroked her down, saying, "So mully," but when John went to milk her he said: "Get round, you brat!" and struck her upon the hip. It is a fact, you cannot get good results from cows any more than you can from human beings when you treat them ill. It is of the greatest importance that barns and stables be made warm and comfortable for our cows in winter. The fact that food is very expensive fuel, ought to come home to every dairyman. It is easy to stop up the cracks, and make warm stables, shutting out the cold and thus preventing unnecessary loss.

It will require fifty per cent. more to keep cows in good condition when housed in a stable full of cracks, with the wind whistling through than when sheltered in a warm, comfortable one. It is easy to demonstrate that the saving in a dairy of thirty cows in food and product for two years

when housed in a warm stable, as compared with the same number kept in a cold and comfortless place, would be sufficient to build a barn with concrete air tight stable walls underneath, with sash and double glass in it, warm and comfortable, all complete. This might be constructed from two years' savings. A cow fed all she will eat in a cold building will give less milk than when kept in a warm one. Cold tends to prevent the secretion of milk. There will be a saving of ten dollars per annum on each cow. This will amount to six hundred dollars in the two years. I built a wall under a barn of an octagon shape, which was two hundred and twenty-five feet in circumference, for $250. This was less than was saved in one season. The concrete wall is impervious to air and moisture, and is the cheapest wall that can be built. It can be built for ten cents per cubic foot, in most places, where sand and gravel can be obtained. The great advantage of the concrete wall is that it can be built without any skilled labor. All that you require to know is what proportion to mix the constituents, and to put it into the boxes. Take sand and gravel, having sufficient sand to fill the interstices between the gravel, and using one shovel full of water lime to five of sand and gravel, and you have there a concrete mixture that will become as hard as a rock. Place the boxes and fill to the top, and then another and another layer, until the wall is completed. You must not forget to always give your animals plenty of light. We all of us like sunshine. A dog or a cat you will notice always lies down in that part of the room where the sunlight falls, and a cow will do the same thing. All stables should have light, which is a very important element.

The President, Mr. Burrill—I will refer to an unwise custom, which has become quite common in central N. Y. among dairymen, that is of buying much of their stock and produce for food instead of raising them. I would urge upon all dairymen the advisability of raising their stock and produce.

Prof. Arnold—Mr. Sheldon spoke of ceiled curing rooms. A ceiled room, especially if painted and varnished, will retain the heat much longer than a plastered room. If you examine closely the wall of a plastered room, you will see that it is very porous and allows the air to pass through it readily, and will therefore change from hot to cold, or vice versa, in a short time. Plastering is also objectionable as a receptacle of filth from the air which is always straining through it.

Mr. Casswell to Mr. Arnold—If, say, 1,000 cheeses were put in a perfectly tight curing room, without any ventilation, would they take harm?

Mr. A.—I think not in the earlier stages, and perhaps not in the later, unless some of them were off flavor, when the foul air would need to be replaced with better. The most serious difficulty with the tight room would be the great dampness of the air, causing the cheese to mold.

Mr. C.—If cows were fed whey, or anything capable of imparting bad odor, could you detect it in the cheese, and did you detect any such odor in the cheese at the Centennial?

Mr. A.—Yes; feeding cows whey gives a peculiar flavor to cheese, and in examining cheese at Philadelphia, we called the attention of the Superintendent to the fact, and found that the cows furnishing milk to the factory where the cheese was made were fed whey.

Mr. C.—Did you detect carrion taint, caused by carrion lying round where the cows could breathe the scent?

Mr. A.—I did. I have met with many cases of this kind. A very striking case of this kind occurred in the Canadian cheese at Philadelphia. I examined a lot of four cheeses made on four successive days. The first was distinctly charged with the taint of carrion. The second was entirely free from it. In the third it was again distinct, but in the fourth none. Upon inquiring into the circumstances of the dairy, it proved that the carcasses of dead calves had been lying around the yards all summer. The reason that the cheese were not all affected alike was doubtless that on some days the wind blew the scent away from the cows and on others toward them.

Question to Mr. Sheldon—What is the best way of heating a curing room so as to keep an even temperature? By means of steam pipes for hot water, or stoves?

Mr. Sheldon—I have had no experience, comparing the different methods, but would think steam pipes would keep a more uniform temperature. A good stove covered or enclosed with a metal jacket opened at the bottom and top, would keep a very nearly even temperature.

Mr. Farrington—I trust that we will all endeavor to put in practice the excellent precepts we have heard, for perhaps after all the greatest leak in the dairy is that where we hear such excellent addresses as those of Mr. Sheldon or Prof. Arnold, we allow the benefit to leak away instead of putting them into practice. (Applause.)

On motion the Convention adjourned until two o'clock p. m.

WEDNESDAY AFTERNOON.

The Convention was called to order at 2 o'clock, Mr. George Hamilton in the chair.

The first paper was by Prof. E. W. Stewart, on

DAIRYING AND FERTILITY.

Mr. President and Gentlemen,—It is pleasant thus to meet in fraternal association. Agriculture is the basis of all human prosperity, and there is nothing in its prosecution that need hinder the cordial co-operation of our people with yours. This Association represents the greatest single Agricultural interest in the United States and Canada; the dairy is the right arm of the great stock interest.

If we deduct the cows used simply for breeding purposes and furnishing food for their calves, there will remain in both countries about 10,000,000 of cows, producing an annual product, at $40 per head, worth in the market $400,000,000. This, although a moderate estimate, is greater than the value of the cotton crop, wheat crop, or any single crop save that of grass, which is consumed by every class of stock, and thus makes up a part of the income from all. This is the present status of the dairy interest, but it is destined to an increase year by year, until it shall reach vast proportions. Throughout the dairy belt of North America, the cow is to be the great food producer and the largest source of profit. It then becomes a most important problem to determine the effect of dairying upon the fertility of the dairy farm—for the dairyman cannot afford to pursue a system that will lessen his capacity of production.

Happily a knowledge of this question is not surrounded by any insuperable difficulties. For if we study attentively all the facts connected with the dairy system, we shall see, pretty plainly, the effect upon the soil.

The cow has no independent power of producing anything. Her own body, as well as the milk she yields, is made from the food she eats, and the most important elements of this food come from the soil. If the product of this food, eaten by the cow, is returned to the soil, it will become more fertile than before; but if the product is largely carried off the soil will become impoverished to that extent.

WHAT MILK TAKES FROM THE SOIL.

Milk contains about six-tenths of one per cent. of mineral matter, and a thousand pounds of milk would contain six pounds of ash which is composed of phosphate of lime, carbonate of lime, soda, sulphur, magnesia, etc. A cow, therefore, that gave 4,000 lbs of milk, while in pasture, would remove from the soil 24 lbs. of these mineral constituents. If a steer is pastured during the same time and gains in live weight 300 lbs., his flesh, so put on, will contain two per cent. of ash, or 6 lbs of mineral matter—only one-fourth as much as the cow carries off in her milk alone. Then if we examine the other important fertilizing matters in the milk—the albumenoids, the casein amounts to about 4 per cent. or in the 4,000 lbs. of milk 160 lbs. of casein containing 25.6 lbs. of pure nitrogen, whilst the 300 lbs. of flesh put on the steer would contain only about 10 per. cent., or 30 lbs. of albuminoids, and 4.8 lbs of pure nitrogen, or less than one-fifth as much as the milk of the cow.

If, then, we suppose the waste in the system of the cow and the steer is the same, the cow will carry off, in mineral constituents, four times, and in albuminoids five times as much as the steer or the cow if not in lactation. Now in either case we only estimate the mineral and albuminoid matter—taking no account of the carbohydrates carried off. These being composed of carbon and water may be derived from the atmosphere. It will thus appear that when the milk is sold the cow is much more depleting to the soil than the beef animal.

But all dairying does not bear the same relation to fertility. One system of dairying may even improve the fertility of the soil by constant feeding of milch cows to the full capacity of the soil, whilst another may surely deteriorate the same number of acres in feeding the same number of cows—all being dependent upon the use that is made of the milk.

The best system of dairying to preserve the fertility of the soil is

BUTTER-DAIRYING.

What we sell from the products of the farm, not what we raise and feed to be returned to the soil, impoverishes. The more crops we grow, the more animals we feed—if all is returned to the soil—the more fertile it becomes. The taste of the American people renders cream the most valuable constituent of milk, and when this is converted into the most delicious butter, it brings more money than the whole milk made into cheese. This has caused butter-dairying to be the principal branch carried on in the United States; and until the cheese factory so improved the quality of the product as to raise the price of cheese, both in the home and foreign market, butter formed four-fifths of the marketable product of the market.

It was thus from the manufacture and sale of butter that the so generally favorable impression of dairying was formed. And if we examine the composition of butter we shall see that it contains no mineral matter. It is composed wholly of carbon and water, and, if pure, is entirely combustible—taking no valuable constituents from the soil; all its elements may be derived from the atmosphere. Yet carbon has its value for it assists in the mechanical texture of the soil, rendering it more porous and friable; yet in selling butter the dairyman sells no mineral or valuable constituent of the soil—nothing which may not be derived from the atmosphere. This kind of dairying, then does not impoverish, but when the refuse milk is fed to animals, the mineral constituents nearly all go back to the soil in a higher state of organization and may even increase its fertility. It may be mentioned that the pig has the least weight of bone in proportion to weight of carcass, and it is therefore better for the soil, to feed the refuse milk to pigs, for then the least phosphate of lime is sold. But when the skim milk is fed to calves only a small proportion of the constituents of the milk is sold; yet it is not as profitable to feed calves, except such heifer calves as are necessary to replenish the dairy, as to feed pigs, for the same quantity of skim milk will make more pounds live weight upon pigs than calves, and pigs are usually worth more per live weight than calves. Sixteen pounds of skim milk will make a pound of dressed pork on pigs from 4 to 26 weeks old, and if worth 8c. per pound will pay one half cent per pound for the refuse milk, thus yielding an income of $20 per cow for the season. The manure made from pigs fed upon milk is very rich, and when this is properly deodorized with muck and re-applied to the soil there will be little loss of fertility by dairying. Butter-making is therefore the best form of dairying to perpetuate the fertility of our farms.

SELLING MILK.

But if the milk is sold all the mineral and nitrogenous constituents of the milk are lost to the soil. In this case, nothing of all the food eaten by the cows is returned to the soil, except the indigestible and unassimilated portion, together with the constant waste of their system; and this return of food to the soil does not exceed one-third of the food eaten by a vigorous and large yielding cow. And it is not probably overestimating the loss of mineral and nitrogenous constituents, when the milk is sold, to say that two-thirds of all the cow consumes is carried off and lost. In order to get a clear understanding of the comparative loss by beef-feeding and dairying, we must compare the dry substance in beef and milk. If the steer lays on 300 lbs. of live weight during the pasturing season, 25 per cent. of this is dry substance, and 75 per cent. water. The steer will thus store up 75 lbs. of dry substance. Milk is composed of 87½ per cent. water and 12½ per cent. dry substance, thus two pounds of milk contains as much dry substance as one pound of live weight beef. The opinion is no doubt quite general that a pound of dressed beef is equal in substance to five or six pounds of milk, but it is only equal to three pounds of milk, as the average beef upon our markets contains 65 per cent. water. If, then, a cow yields 4,000 lbs. of milk during the pasturing season, it would contain 500 lbs. of dry substance, and this is of course obtained from the grass she eats. But, as we have seen, the mineral constituents, or ash, of this 500 lbs. amounts to 24 lbs., which is all taken

from the soil, and the casein, or albuminoids, is 160 lbs., containing 256 lbs. nitrogen and most of this derived from the soil.

Now, if dairying, accompanied by the sale of milk, is to be carried on for a series of years it must be evident that the soil must be steadily impoverished, unless the dairyman, to guard against this deterioration, shall supply this loss by the application of fertilizers containing the elements constantly carried off. This will not be either difficult or expensive, costing only about $2 per cow.

The points we have made will show clearly the difference between feeding cows and selling milk and feeding steers for beef.

SELLING CHEESE.

But suppose the dairyman, instead of selling milk, manufactures it into cheese or delivers it at the cheese factory. Will this stop the drain of mineral and nitrogenous matter from the soil? Let us see what he retains to go back on his land. He takes his milk to the factory and brings back only the whey or milk sugar. Whey is simply carbon and water, containing no mineral elements, except in the small amount of casein and albumen that may have floated off in it. When for any cause the milk contains albumen, this passes off in the whey and adds so much to its value as a food and as a fertilizer.

But whey has very little manurial value—its only office is to supply animal heat and produce fat. The casein of the curd contains nearly all the mineral matter and this is sold in the cheese—the soil gaining next to nothing, practically, in cheese-making over selling the milk. It is true that the skilful feeder may profitably use the whey as a food by mixing with it other food, rich in albumenoids—such as oil-meal, pea-meal, oat or barley meal, and thus add to his income. But cheese-dairying is practically the same as selling milk so far as the loss of the fertilizing constituents of the soil.

We do not wish to alarm dairymen by presenting this practical view of the case, but it behooves them to look the facts square in the face, and if their present system is faulty, the sooner they mend it the better. Dairying for long periods of time in England has been found to deplete the soil of phosphate of lime. Prof. Voelcker, speaking of the introduction of bones as a manure, says: "Nor is it merely from their association with the great and leading reform in British husbandry that bones derive their position. But in reclamation of wastes, and in the restoration of fertility to the worn out pasture lands, which had been exhausted by the constant removal of milk, cheese, &c., from their surface, bone manure has been scarcely less beneficial than in turnip husbandry." Here he recognizes the facts which we have sought to establish in this paper.

Prof. J. F. W. Johnston, one of the most careful of English writers, says: "Every 40 gallons of milk contains one pound of bone earth, besides other phosphates. Estimating a cow to yield 750 gallons per year, it will require 19 lbs. of phosphate—equivalent to 30 lbs. of bone dust. If the calf is sold off we may assume there is a loss of 20lbs. of bone, and the waste of phosphates in the urine equals 4 lbs. And thus, for every cow a dairy farm maintains, it will lose of earthy phosphates as much as is contained in 56 lbs of bone bust." A writer in Morton's Cyclopedia, speaking of Prof. Johnston's estimate of the loss of urine, says: "The

waste of phosphates in urine is much greater than Prof. Johnston has here estimated. A cow not in milk gives 1,300 gallons of urine, containing nearly 20 lbs. of phosphates." But we understand Prof. Johnston to speak, particularly, of what is lost to the soil in the production of milk by the dairy system. And if it requires 56lbs. of bone dust to replenish what is carried off by a cow in the production of milk, then this depletion cannot go on indefinitely without absolute impoverishment.

We have gathered these few points showing the effect of dairying upon fertility, as merely suggestive, and to give the dairyman notice of the danger ahead, that he may balance his account yearly with his soil, and not go on drawing out, little by little, all his rich resources, without ever once making a deposit to strengthen his credit.

DISCUSSION.

Mr. Craigg—Prof. Stewart has advised artificial fertilizers to keep up the condition of our soils. As we milk our cows but six or seven months in the year, and in the winter feed them in addition to hay and straw, pea-meal, corn-meal, &c., if the manure thus formed were all returned to the soil, would not that keep up the fertility and save the expense of the artificial manures?

Prof. Stewart—If the dairymen have abundance of food from other sources than their pastures for their animals, there is no question but they can keep their pastures in fine order for a length of time. What I spoke of was that if the farmer is constantly selling off his milk without returning the mineral ingredients necessary for the production of milk, he will be constantly lessening its capacity. A provident farmer does not want to be constantly drawing out from his bank account without replenishing. Two dollars an acre spent in commercial fertilizers will supply the deficiency and prevent the land from becoming impoverished. Now, suppose you have a dairy, each cow of which will yield 4,000 lbs. of milk in a year, you can afford to pay the paltry sum required to replenish the soil and keep it constantly increasing in fertility.

Question—What commercial fertilizers would you recommend which could be had for two dollars an acre.

Prof. Stewart—The best fertilizers are bone dust, German and potash salts. Two dollars in the purchase of finely ground bone dust, or what is better, bone dissolved in sulphuric acid, or superphosphate, and applied to the land, that amount per acre would replenish the soil. You cannot produce something from nothing. Extra tillage causes the farmer sometimes to believe that his land is improving when it is really growing no better. There are more poor crops from poor tillage than from any other cause. You might go on for a few years with increased extra tillage without noticing the destitution of the soil, but it would be all the more marked when it did come. As you say, if he raises grain upon a certain part of his farm in the summer, and in winter feeds it all to his stock, and the manure produced be all carried back to the land, its exhaustion would not be so rapid, it is true. But where will you get the mineral matter which is carried away with the 4,000 lbs. of milk during the summer unless you see to it, that these extra fertilizing ingredients are restored to the land?

The Germans have made great progress in agricultulture and have found the advantages of cultivating the beet. It shoves down its top

root and brings up the fertilizers from the subsoil below. Canada can raise all the sugar it wants, and by feeding the refuse of the beets to the cattle carry more cattle than on the old system, and make a clear profit on the sugar besides, as the Germans do, and the soil will apparently be richer, but by-and-by its poverty will be seen. It pays a good percentage to feed dairy cows highly, thereby increasing the yield of milk, thus adding to the revenue and also keeping the soil in full fertility. Those who purchase largely of the oil-cake and such like find a satisfactory return. I am ashamed of the want of practical talent among many of our Americans in this respect. Oil-cake is worth much more to dairymen than it costs. It seems to keep the digestive organs of the cows in complete order. I have used it for years and I think it has paid me twice over. You Canadian farmers have adopted the habit of raising peas, and pea-meal is very good. When you can give a cow a quart of pea-meal, and a quart of oil-meal you are giving a combination that will produce a larger quantity of milk than in any other way. I want to say in this connection that every animal should be fed intelligently and for the purpose intended.

Many suppose that one kind of food is as good as another if they will only eat it. You take a quarter of a pound of oil-meal, and mix it with a gallon of whey and feed it to a calf or pig in that proportion and you will find it will produce the greatest growth, it will develop the bone and muscle of the animal ; whereas, if you feed whey alone, you simply give sugar, and you cannot form bone and muscle out of sugar. Pea-meal is also very rich in oil and nitrogenous matter.

Question—What do you think of leached ashes as an application to supply the deficiency ?

Prof. Stewart—It is valuable, as it contains in small proportion the very elements that I mentioned as carried away in the milk. It is not suitable, however, for land that is permanently wet, but, applied to dry soils, it is very valuable, and attracts the nitrogen from the atmosphere. Gas lime is also useful, but should not be applied alone ; it should be composted with muck and earth and allowed to stand a year, or even a few months, when it may be applied with advantage.

Ques.—What is your opinion of the practice of selling wood ashes ?

Prof. Stewart—It is very foolish. Wood ashes are worth fifty cents per bushel to apply to the land, and no intelligent farmer will sell them for a few cents a bushel. I have drilled them in with oats and spring wheat with the best results. I never failed to get an increase of from five to to six bushels per acre the first crop. No man can afford to sell his ashes.

Ques.—If ashes are so valuable, why is not their value not more generally known by farmers ?

Prof. Stewart—You might as well ask why farmers do not know more than they do. I used to send my team and collect 1,000 bushels a year. The enquiry began to be made : " What does Mr. Stewart do with those ashes ?" On being told that he put them on his land it was said : " Well, if it is good for his land it is good for mine !" (Laughter.) I find now that it is rather expensive gathering them. My teamster gets small loads. The potash boilers say they can get them. They seem to think that is legitimate and are cautious to know what they want them for, forgetting

all about their value. If farmers in a neighborhood would unite in forming agricultural societies, and each member try experiments and report the results to the little club or organization, you have no idea how much good it would do. It would have the effect of dispelling many erroneous views.

On motion made by Mr. Losee, and seconded by Mr. Craigg, a hearty vote of thanks was given Prof. Stewart for his address.

Prof. Stewart—I am certainly very much gratified to see the attention paid to my remarks, and I assure you that the most satisfactory pay I can get is, to have your close attention and appreciation of them. (Applause.)

Mr. Thos. Ballantyne, M. P. P., was then called upon to address the Convention on the

MANUFACTURE OF CHEESE AND THE HANDLING OF MILK.

He said: Ladies and Gentlemen,—It gives me much pleasure to have the opportunity to meet with you on this occasion, and contribute my mite to the discussion of those subjects in which we are interested. I regret that my engagements have been such that I have not been able to prepare a paper on the subject allotted me, namely, "The Manufacture of Cheese."

I suppose the reason why I have been selected to speak to this subject is because of the accident that the factory which I own was the successful competitor at the Centennial Exhibition.

I would say then, the first thing necessary in order to make fine cheese is to have the milk in proper condition at the commencement of the process of manufacture. And here it is very difficult to lay down rules that can be applied in all cases to the reception of the milk at the factory, as no two factories receive it exactly the same way. Some receive it once a day, and others twice. Some factorymen draw it themselves or see to the drawing, and have the care of the cows, while in other cases the patrons draw their own milk, but whatever plan is adopted, it is absolutely necessary that the milk should always be in good condition when it reaches the factory. To accomplish this the factorymen and all connected therewith must see to it that their arrangements are such, that proper attention to cleanliness is preserved throughout. Unless the pans and utensils are properly and regularly washed,scoured and scalded, a really fine cheese cannot be manufactured. Having then the first requisite milk in proper condition, we are ready for the process of manufacture.

In the first part of the season it is very desirable that the cheese be made to ripen early; the sooner it is ripe the better. How is this to be done? By using rennet very freely. In the early part of the season we use sufficient to cause it to coagulate in 25 or 30 minutes, and draw off the whey at the approach of the slightest acidity, allowing the curd to fall to the bottom of the vat, salt slightly and generally observe the plan used in the cheddar process. We do not regard the keeping qualities so much, at this season, but desire to have it ready early for the market.

When the season is advanced we use a smaller quantity of rennet; only sufficient to cause coagulation in 40 minutes, drawing off the whey on the approach of the slightest acidity, and packing the curd at the side of the vat.

The great question is to know the requisite degree of acidity. This can only be acquired by experience. Each practical cheese-maker must find for himself what is necessary to make a solid clean cheese.

In the summer season we use a smaller quantity of rennet and a larger quantity of salt, say 2½ lbs. of salt to 1,000 lbs. of milk. In the Spring never using more than 2 or 1⅓ lbs. Of the cheese that reaches the early market defective, a great proportion of it may be traceable to the fact that rennet was not used in sufficient quantities. Another great cause of imperfect early cheese is defective curing rooms. It is absolutely necessary to keep up a proper temperature. In the Spring it requires to be higher than in the Fall. A temperature of 65 degrees will be necessary in the Fall, and 75 degrees in the Spring. The milk in the Fall contains more butter than in Spring.

From my observations and experiments during the past two years, I have come to the conclusion that a great deal of the worst cheese does not come from bad milk, but from carelessness in stirring the curd during the cooking process.

While the heat is being applied the curd falls to the bottom of the pan, when the temperature is greater than blood heat, and coming in contact with the bottom, is somewhat wilted or scorched, and this gives the taste of toasted cheese.

I have not the slightest doubt that in most cases strong cheese is produced from that cause. It is very important that the heat should be gradually and regularly applied, the water being raised to from 82 to 84 and 86 degrees, during which the stirring should be carefully kept up. This heating process should be completed in from one hour to an hour and a half.

In the spring when the temperature of the vat is apt to become reduced on account of the low temperature of the atmosphere, it is very necessary that you keep up an equal temperature or you will have sour, sticky, poor cheese, if you allow the curd to become too cold when putting it to press.

I am sorry I was not able to prepare a paper on this subject. I do not like this rambling way of speaking. I suppose I have some things of the greatest importance, and mentioned some that were familiar to all.

I would strongly urge cheese makers to visit other cheese factories whenever they have an opportunity, especially those that have the reputation of making a fine article. I do not know anything by which they can assist themselves more than by taking that plan. I remarked last year that there were simply four agencies in the manufacture of cheese. I will again mention them, and urge upon you the importance of giving the greatest attention to each. The first is heat. This must be applied very gradually. The next is rennet, not merely to coagulate the mass, but to assist in the curing process. The next is salt. Care must be taken to use neither too much nor too little. The fourth agent is acid, which, if not the most important, is quite as important as any of the rest. By the cheddar process you are better able to regulate the acidity.

I do not think it is desirable to occupy your time longer. I will with pleasure answer any question, if possible, that may arise in this connection.

Ques.—What mode of heating the curing house do you use?

Ans.—By a large stove at present, but it is not very satisfactory. I am satisfied that coal stoves are better.

Ques.—What arrangement have you in your curing room for reducing the heat.

Ans.—Nothing but the ordinary double wall and holes in the floor.

I would not have a second story for a curing room. There is usually a difference of from 4 to 5 degrees between the upper and lower story. I do not know of any better way of keeping the curing room cool in very hot weather than by having the windows open in the morning when cool, but closing them during the hot part of the day, and sprinkling the floor freely with cold water. It will reduce the temperature several degrees. We always find in the early part of the season a great many poor cheese, which it is my impression is caused by the use of too little rennet, and not keeping up the temperature sufficiently.

In answer to further enquiries Mr. Ballantyne continued: We adopt the plan of heating up the milk for an hour or an hour and a-half before adding the rennet. We have found the best results from allowing it to be about three hours or three and a-half in the curd state. It may appear strange, but it is nevertheless true, that it is impossible to make fine cheese from pure sweet milk, and we adopt the plan of keeping the milk heated up a while before putting in the rennet. In the Fall of the year usually two hours. Sometimes we add a little old milk.

Ques.—Do you advise the use of sour milk?

Ans.—I do not.

Ques.—Do you use dry steam or water?

Ans.—We use water.

We regard it much safer to have the milk reach a certain stage of ripeness than to use old milk or sour whey. Milk must reach a certain stage of ripeness by age to make the best cheese or the best butter.

Ques.—Would it not be well to have the patrons cool the milk down?

Ans.—No doubt, but we must take things as we find them. If the patrons cool their night's milk at home, and send the night's and morning's milk in different cans, my experience satisfies me that good cheese can be made from milk delivered once a day. We had a cheese fair in Stratford, and the factory that took the first prize made but once a day.

Ques.—You spoke of mixing the night's and morning's milk together when drawing once a day. Will you explain the advantage of keeping them separate?

Ans.—If the morning's and night's milk are put in the same cans, I think you will all agree that it will not be in the same condition when it reaches the factory as it would be if delivered separately. I however know factories not receiving a drop of milk in separate cans where they have had exceptionally fine cheese.

Mr. Hattley, of Brantford—It would be well, I think, to consider the advisability of making white cheese. I believe buyers have to too great an extent encouraged the making of white cheese. I think the demand for white cheese is confined mostly to a small district of Lancaster. I found that I had to take a cent a pound less for white than colored cheese.

Mr. Ashley—In the vicinity of Belleville white cheese in some cases

brought more than colored. I would think, from my observation, that about one-tenth of the make should be white.

Mr. Casswell—I can look round on this Convention and point to several gentlemen who, by the advice of buyers in the spring made considerable white cheese, but when the time came round for them to be taken, those buyers would not take them. A certain amount can be made with advantage, but if any large quantities are manufactured the factorymen must lose by them. If made at all they must be very fine. Many a man can make apparently a perfect colored cheese who can not make a perfect white one. Before taking my seat I will say I believe if a dairy institution were established, under the charge of practical dairymen, like Mr. Ballantyne and others, where pupils could go for a month or two and receive instruction, the results would be of immense benefit to the dairy interest. Now I am satisfied that if some plan could be hit upon by our association by which such an institution could be established either in connection with the model farm or otherwise, great good would result from it.

Mr. Ballantyne.—I have long been of opinion that a great improvement in the dairy system would be to have nine or ten factories under the management of one experienced cheese maker. In that way uniformity of quality would be secured. There is in Western N. Y. such a system called the Clover Field Factories. The cheese from these factories command the highest prices all over England. One individual has the charge of all of them. I confess I cannot see very clearly, under our present system of private individual factories, how such a scheme can be carried out. It would be a great advantage to cheese makers if they had an opportunity to run off, even two or three days, to such an institution as recommended by Mr. Casswell. It would be of great benefit.

Mr. Craigg—I highly approve of those remarks with reference to the education of cheese makers, and I also think that great good would result from holding meetings of the patrons in different neighborhoods, and have those meetings addressed by competent persons, and thus educate the rank and file on these subjects.

Mr. Losee—If we devoted some of the money of the Association to employ a talented lecturer, it would be well employed.

On motion of Mr. Hopkins, seconded by Mr. Farrington, a hearty vote of thanks was given to Mr. Ballantyne for his excellent practical address.

Mr. Ballantyne—I thank you for this hearty vote of thanks. It is always to me a pleasure, and I feel it to be a duty to do what I can to improve the quality of our cheese. Poor cheese is always a drag in the market. If one factory can make a fine cheese all can. We have many things to contend with. The climate goes to great extremes. We realized the effect of this last year. During the first two weeks in August it was almost impossible to make the finest goods. But I have no doubt the immense quantity of poor cheese thrown upon the market every year is mainly caused by carelessness in the manufacture, or imperfect curing rooms. (Applause.)

The following committees were then appointed, viz.: Nomination, Finance and Dairy Apparatus.

The Convention then adjourned until 7 p. m.

EVENING SESSION.

The Convention re-assembled at 7 o'clock; Mr. Burrill occupying the chair.

Letters were read from the Hon. George Brown, Prof. Bell, of Belleville, and P. R. Daly, President of the Ontario Dairymen's Association.

The President said that but for the storm that had prevailed on the other side, blocking up the roads, a large number of Americans would have been present. The storm had not had its equal since 1864.

Hon. Harris Lewis was then introduced who delivered an address on the

"FITNESS OF THINGS."

He said: MR. PRESIDENT, LADIES AND GENTLEMEN,—In addressing you on the subject of the "Fitness of Things," I would first call your attention to the wonderful adaptability of means to ends which is exhibited in all the works of nature. If you examine the inhabitants of the ocean, from the smallest, a million of which would not fill a lady's thimble, to the most gigantic monster, you will find that each is fitted for the exact locality where they are to find and provide food for their subsistence, and obtain it with the least labor and the greatest certainty. The same fitness of things you will find not only in all the animal creation but also in the vegetable kingdom, from the most tender flower and shrub to the most gigantic tree of tropical climes. So, too, man, the crowning glory of the Creator's works, is fitted for certain conditions and duties suited to his nature.

I hold that every man, woman and child is fitted by nature to perform some act or discharge some duty in life better than any other. But man in his ignorance often thwarts nature's operations and designs, and turns them into worse than useless purposes. Many parents seem to look upon labor as degrading, and try to find some higher place for their children, rather than encourage engaging in useful labor. It is a sad picture I know, but it is the case with many in the United States. I hope it is not so on this side of the lines. Now, to succeed in any business, calling, or profession, there must be more or less adaptation for that particular business or calling and a love for it.

Now with regard to the fitness of things in connection with dairying or farming, having determined to engage in that particular business, the first thing to be considered is to secure a farm adapted to it. If you have made up your mind to grow grain then select the best grain-growing farm in the country. If you have resolved to go into dairying then get the best farm for grass you can find.

Having secured the farm and fitted it for business the next thing will be to select a herd of cows for it. You should get the very best. Would not this be sensible? I told you last year that only one cow in three paid her way—that all the profits were made from the third cow.

If you adopt the butter branch of dairying, then select them for that purpose. The only way of testing the butter or cheese producing capacities of cows is to weigh the product. In entering upon cheese making, I think I would recommend as the first thing the selection of a partner in the business, one who would be a proper helpmeet. This, I think, would be according to the fitness of things. Having found such a one I would

make her my confidential adviser in all matters connected with my business. Man may be right from reason, or reason himself wrong, but a woman is impulsively right.

If you make up your mind to engage in marketing milk, your herd must be selected for that purpose. And here I would recommend the Holstein breed as the best for a milk farm. The milk of the Holstein breed will bear transportation well, the milk globules being very small. All these things must be considered in fitting yourself for your life business. Then you want food for the cow fitted for her wants and condition. You should provide the very best food you can get. Never feed your dairy cows straw or coarse corn stalks. I would not call that food fitted for her wants. Then you should treat the cow with the utmost kindness, and see that the help you employ are qualified for the business, and those you can fully trust. If possible employ men that know more than you do, and never tolerate a brutal man. If you should unfortunately employ such a one get rid of him as soon as possible. Fulfil your part of the contract and let him go. I had such a man in my employ once, who came near ruining one of my best cows by striking her with a shovel. It took a long time to convince that cow that everything wearing pants was not as cruel as that man. (Laughter.) When I am around my cows they are sure of kind treatment. If they are not comfortable, free from annoyance and fear, they will not yield as much milk, neither will it be as good. Unkind treatment of the cow shows itself first in the quality of the milk, and then in the quantity. God has no place on earth for a brutal man—if he has it is not in the dairy. The implements we use on a farm or on the dairy must be chosen in accordance with their fitness for the purposes required.

I will in this connection relate an incident. In 1855 I purchased a piece of land in the Mohawk Valley, and on this land were a number of Mohawk Valley bogs. At that time I had a German in my employ, a faithful and reliable man, as many of the Germans are. One day I said, "James, you may take the bog hoe and go down yonder and cut those bogs, and throw them into the river." "Yes, sir," says James, and went to attend to it. Many of you Canadians may not know much about Mohawk Valley bogs. They grow sometimes as large as a bushel basket, the roots shooting downward in the earth. To say that they are tough would not begin to describe them. I did not notice James particularly until about two hours after when I saw him coming back. His face was red, his clothes wet with sweat, his countenance indicated disappointment, sorrow and remorse. The secret of it all was revealed when I saw on his shoulder the post-hole borer. I commenced to laugh at the ridiculousness, the absurdity of the thing. (Laughter.) I went to the shop and got the bog hoe, an instrument very much like the adze of a carpenter, with which by giving a blow or two on one side of the bog and then on the other it is easily conquered. In fact, it is an instrument fitted for that work. James went away a good deal encouraged, and in due time came back with satisfaction, joy and victory, beaming in his countenance. "Mr. Lewis," he said, "Dish is betterish good." (Laughter and applause.)

I have often rejoiced that I laughed over him instead of storming for I have often found myself cutting my bogs with a post hole borer, and if

there is a man or woman here who has lived thus far and never made the attempt to cut one bog in that way, let them rise up. (Laughter and applause.) Now I think I have occupied your time long enough. I thank you for your kind attention. (Applause.)

Mr. Farrington—Mr. Lewis advises us to get the best grass farm we can for dairy purposes. If we cannot get the very best in the country, to get the next best. Now, if the best farm we can get is not as good for grass as we could wish I hope he will allow us to grow some corn. There are numerous places in the West not suitable to growing grass, and in California to-day everything is perishing on account of the drought. What must they do? Corn must be their dependence when grass fails. If we could get a sufficient quantity of fine grass, timothy, or white clover, and stow it away against a dry time, it would be preferable, but if not we must do the next best thing. As an evidence of the great value of corn, look at the great city of the West, Chicago. It is built on corn. Its wealth and superstructure is on corn. It was burnt down, being set on fire by a cow kicking over a lamp.

Mr. Lewis—I don't blame her. They were trying to make her eat corn stalks. (Great laughter.)

Mr. Farrington—After it was burnt it sprang up almost in a night as it were. I have no doubt that Mr. Lewis has proved many a time that corn stalks well saved were an excellent help. When properly grown, and cut just in the flower, they contain a great deal of nourishment, and if all are not needed in the fall, if properly preserved they will winter our stock better than the average hay.

On motion a hearty vote of thanks was given Mr. Lewis for his address.

Mr. Lewis—I think my thanks are due to you for your patient attention. Allow me to say that while we provide for the fitness of things pertaining to this life, let us not forget to fit ourselves for the life which is to come.

Prof. Stewart—An old dairyman—a friend of mine—who usually keeps from 100 to 120 cows, raises corn as one of the most important crops. He found nothing cheaper for his cows than corn cut when it was passing from the milky to the doughy state. It is equally as good for butter making as for cheese.

Mr. Lewis—The cow tells me by actions that speak louder than words that grass is better than corn.

Prof. Arnold—There is no question about the value of corn, and dairymen generally prize it very highly. It is not only fitted for producing milk but also for putting on fat and flesh. There is a time in the life of the growing stalks when they contain, easily formed, all the nutritive qualities of the future crop of grain they are capable of producing. This is when the kernels are just ready to form. Since the grain of maize is everywhere acknowledged to be a valuable food for milch cows, it hardly admits of question that if corn-stalks are cut and fed or dried, just at the time when they hold elaborated in their sap all the nutriment of a future crop of grain, that they are a valuable and appropriate food for cows in milk or otherwise.

Question to Mr. Farrington—Have you noticed an increase of milk from feeding fodder corn.

Mr. Farrington—They are usually fed too late in the milking season to produce an increase, but they keep up the flow and increase flesh.

Mr. Webb—We have adopted the plan of cutting up our stalks. The cattle eat them more readily, and there is no waste.

Mr. Ashley—We cannot help admitting that corn is a great substitute for grass.

Mr. Hopkins—A year ago last June I planted two acres of corn, which did not ripen, and I necessarily fed the whole just as it was, and I never received more benefit from any two acres of land.

The Convention adjourned till 10 o'clock next morning.

THIRD DAY—MORNING SESSION.

The convention assembled at 10 o'clock, Mr. Ballantyne presiding. Upon taking the chair he announced as the first order of business a paper on the

ADVANTAGES OF EXPERIMENTAL DAIRY STATIONS,

prepared by Prof. Bell, of Albert University, Belleville, which would, in the absence of the Prof., be read by C. E. Chadwick, Esq., who was then introduced.

In estimating the comparative value of the several branches of industry which, united, form the wealth of the United States, it needs no extensive or involved statistics to prove that the products of the cultivator's toil hold the first and most important place; not only as being necessary to the very existence of the population, but in actual commercial and pecuniary value. The cotton, sugar and rice of the South, the corn, grain, wool and cattle of the Northern, Western and Middle States, and the fruits of the whole form a total which vastly exceeds in value the coal and iron of Pennsylvania and Virginia, the gold of California, the silver of New Mexico and Colorado, and the manufactures of Massachusetts and Connecticut.

It would naturally be supposed that so vast and so valuable an interest would be the object of especial care and solicitude to both the Central and State Governments throughout the Union, and that the respective rulers would earnestly promote and liberally support any institution, and readily adopt any suggestion which had for its object to increase the quantity and improve the quality of the farm-produce of the whole country, or of that portion of it which lies within their jurisdiction, and more especially would such encouragement be expected to be afforded in a country where the number of proprietors farming their own land is so great, where the average acreage of the farms is so small, and where the Governments are to so great an extent constituted by the vote of the agricultural population.

So far, however, as my information extends, this needed encouragement has not been afforded, and with the exception of their contribution to the expenses of the Centennial Exhibition, a portion of which must be debited to the Agricultural Hall, the sole subsidy given by the United States Government for the promotion of agriculture, is the imposition of a certain amount of protective duty upon the importation of agricultural products.

In olden time, when all the farmer had to do was to scratch the soil, scatter the seed and reap an abundant harvest, this might be sufficient

encouragement, though then it would scarcely be needed ; but now, when the virgin richness of the soil is exhausted over the area of the older settled States, and a higher order of farming has become necessary, in which the science of the chemist and the physiologist must be called in to aid and direct the industry of the husbandry it becomes the duty of those who administer the government to apply for the benefit of the farmers a portion of the revenue to which they are such large contributors, and this can be done most advantageously by liberally remunerating properly qualified persons to conduct those investigations which the farmers cannot do for themselves, and on the correct performance and results of which the maintenance of a prosperous agriculture must mainly depend in the future.

In order to ascertain clearly and intelligently what a government can do, and what it may be fairly executed to do in such a case, we must inquire what has been done by the governments of other countries. In Britain, agricultural colleges and model farms have been established, in which young men can be thoroughly educated in the theory, and trained in the practical working of agriculture ; and the model farm at Glasnevin, in Ireland, is spoken of as one of the most perfect of its class. In Ontario we have an Agricultural College and Model Farm combined, maintained at the cost of the Provincial Government, and though it has been only recently established, and certain untoward circumstances which attended its establishment threatened for a time to interfere with its utility, yet there is now reason to believe that it is doing good work, and to hope that in the course of a few years, the benefits it will confer upon the agricultural population of the Province will largely outweigh the cost, though considerable, of its establishment and maintenance.

In Germany not only are there numerous national establishments in which instruction in scientific and practical husbandry can be obtained at a cheap rate, but there is in each of the principal agricultural centres an experimental station, where, for a trifling fee, farmers can have their soils analyzed, commercial manures tested, and their values determined, and seeds submitted to microscopic inspection, or to the practical test of germination and growth.

I am pleased to observe that in Connecticut there is an establishment of this kind in active operation, from which a very interesting report appeared in the *American Agriculturist* for December, 1876, which attests more strongly the value of such institutions than anything that I could advance.

Thus it appears that, taking the world at large, a good deal has been done for the instruction and encouragement of the tiller of the soil ; while the production of improved breeds of cattle, sheep and horses, has been substantially encouraged by the majority of civilized governments, and I only have to express a sincere hope that these important branches may be yet more liberally subsidized and more extensively introduced, until scientific agriculture, or what is commonly termed " high farming," shall become the rule instead of the exception, and the earth be made to " give forth her increase " in sufficient quantity to feed the ever augmenting myriads of human beings who, generation after generation, go steadily on in the fulfilment of the first blessing, " Increase and multiply, and replenish the earth and subdue it !" And how can man so effectually sub-

due the earth, in the terms of this blessing, as with the plough, the spade and the hoe ?

But there is another branch of agricultural industry which has as yet received but little notice and small encouragement from the "powers that be" on the south of the great lakes : yet which, from the intrinsic value, marketable nature and large amount of its products, shews itself equally worthy of encouragement as the sister branches ; while, from the very nature of the substances with which it has to deal, and the extraordinary variation which favorable or unfavorable conditions, and proper or improper treatment, cause in the quality, and consequently in the market value of its products, it requires more than any other branch of agricultural work the aid of science to discover and determine what those conditions are, and by what means they may be avoided or remedied on the one hand, or induced and made permanent on the other.

Of course I need not tell this audience that it is the dairy interest which has received so little notice from governments in general; and from that of the United States in particular. And yet an interest which produces a total of $500,000,000 every year, $10,000,000 of which are exports, and are returned to the producing nation in cash, or in goods of a still greater value, and the full extent of whose capabilities has not yet been reached, is surely worthy of all the assistance a wise and patriotic government can afford to bestow upon it.

The advantages to be derived from such an establishment, when founded and maintained on a sufficiently liberal scale, are of two classes, having respect severally to the mechanical and scientific or chemical aspects of the business. In the first place it would form a training school for first-class operators, who would hold the same status in the dairy staff as Normal school teachers do in the educational profession, whose example and advice would be of essential service in improving the manufacture in the whole country, as each one of these well-instructed persons would be a focus of valuable information for such of the neighboring operators as had not had the opportunity of attending the institution. Next, there ought to be provision for special instruction so that any operator who had met with a difficulty which unaided he could not surmount, or who found himself deficient in some particular point of practice, might attend for a short time, a few days, or even hours, in which his difficulty might be obviated, or his deficiency supplied, without detaining him too long from his work, or taxing too heavily his perhaps slender resources.

Thirdly, a section should be devoted to the trial of newly invented or improved utensils or apparatus, where they could be contrasted with those in common use, and their comparative, as well as their actual value correctly ascertained.

In the same, or another compartment, different methods of treatment, as well as those practised in other countries, and those in use in the most successful factories of this continent, as others which might be discovered or suggested by members or professors of the institution might be put to practical proof, and those taught and recommended which were found to give the most satisfactory results.

The best method of dealing with floating curds, and tainted milk, would necessarily form prominent subjects of inquiry and experiment.

The quality of the different brands of salt, and their influence upon the

flavour of the cheese, the merit or demerit of the various sorts and preparations of annatto, and the question of coloured or uncolored cheese, could also be investigated and reported thereon. The construction of curing-houses, and the curing, boxing, and shipping, would likewise be attended to, and in short, all the multifarious circumstances attendant upon the manufacture of cheese, of greater or less importance in themselves, but which taken together have considerable effect upon the result of the manufacturing processes, could be taken up in their turn, and if not finally settled to the satisfaction of the inquirers, could at least be carefully and intelligently investigated.

Nor is there less need for an establishment of the kind for the improvement of the other staple article of dairy produce, Butter, which is of equal, or taking into account its much more general use, of superior importance to its sister product. In fact the art of butter-making seems to be thoroughly unsettled, both in principle and in practice. Go into almost any ordinary market, and try the various parcels offered for sale, and you will find them to possess an extraordinary variety of flavor and texture, and among the whole very little that could be rated at more than fairly good, while really fine butter is a rarity. Or read for a twelve-month the agricultural column of any average weekly newspaper, and you will find probably a dozen or more directions "how to make first-class butter," some of which are merely puffs of some particular churn or butter worker, while most of the others are so trivial as to be unworthy of notice or so absurd as to be clearly the productions of persons who know very little about the subject upon which they write—and that little only from books and not from practice.

The chief points to be determined in regard to butter-making are the vexed questions of deep and shallow setting; the form and size of pan which shall afford the greatest facility for the rising of the cream, and at the same time provide for the rapid and complete separation of the milk from the cream, avoiding the tedious process of skimming, which, if not carefully done, is certain either to waste a portion of the cream, or to take up more milk than is desirable; the most efficient pattern of churn for hand or power working, both for rapidity of action and complete separation of the butter from the butter-milk; the most advantageous temperature at which to set the milk, and to work the cream in the churn; washing, salting, packing, and many other matters of less importance, but which, as in the case of cheese-making ought by no means to be neglected. Butter-workers and the comparative advantages of mechanical and hand working would also afford scope for experiment and observation.

It would also be a proper subject of inquiry whether, as is strongly asserted by some a wholesome and palatable article of cheese could be made from skim-milk and butter-milk. If the process were found to be practicable, the resulting product could be sold for a lower price than full-milk cheese, and thus would be adapted to the taste and circumstances of the poorer and more economical class of consumers, both at home and abroad.

Another matter which is worthy of special attention is the extraction of the butter which remains in the whey after the casein or curd is removed. In England this is done to a large extent, and with much profit to the dairy proprietors, as the whey is found to be almost as effective for

the production of pork without the butter as with it, for the substances which mainly go to the production of muscle and fat are the albumen and milk-sugar which remain after both cheese and butter are taken away. Millions of dollars are annually lost to the dairymen of the United States and Canada by their neglect of this source of profit.

It would also be desirable to try whether the milk-sugar can be profitably extracted from the whey after the extraction of the butter. In Germany this is done to some extent, and is found to be remunerative. The article commands a very high price, and the sale is very limited. Its chief value consists in its not being liable to ferment or turn sour on the stomach, which property renders it highly eligible as a condiment for the food of young children and invalids, especially those who suffer from dyspepsia. Perhaps if it were produced in greater quantity it might come into more general use, the supply, as in the case of petroleum, creating the demand.

In the more strictly scientific department much important work remains to be done. A series of meteorological observations should be taken each day at stated hours, and a register kept of the same, in which the indications of the barometer, thermometer, hygrometer, and electrometer should be regularly entered, along with remarks upon the effect of temperature and other atmospheric and cosmical influences upon the material processes, and products of the dairy. These observations might not give, and indeed could be scarcely expected to give, any immediate results, and it might probably be some time before they would be of much advantage to the manufacturer; but I am thoroughly convinced that in the course of a few seasons their cumulative evidence would help to settle many doubtful points, and perhaps might explain and obviate some difficulties which are keenly felt at present, and elucidate some principles which as yet are but dimly seen.

Another important line of inquiry is that instituted by Professor Caldwell, with a view to discover some means of overcoming the tendency of milk to undergo rapid decomposition in hot weather, so far at least as to keep it sweet long enough to be brought to the consumer in good condition, or to be operated upon before any deterioration had taken place. This is certainly a most desirable object, and the interesting and lucid account given by Prof. Caldwell of his experiments and their results, at the Centennial Convention at Philadelphia, demonstrated to the entire satisfaction of his hearers that the object is attainable, and that he is on the right track to attain it.

It would also be in rule to make further observations upon the generation, propagation, and general action and effect of the bacteria, vibriones, fungi, and other low forms of animal and vegetable life, to which the recent discoveries of eminent physicists have taught us to ascribe much more important functions—a much greater effect in the reduction of nitro-hydro-carbonic compounds to their simple elements than we were previously aware of, and which are now known to be capable of affecting the corporeal frame of man and his animals with painful and fatal diseases.

In the physiological and veterinary department crucial experiments would be made on the effects of different sorts of food and management upon the production of milk and quantity of cheese and butter to be derived from their use, as well as their respective influence upon the health

and condition of the animals. The comparative merits of the various breeds of cattle for dairy purposes would be tested; the length of time a cow should be milked for each calf might be determined, as also the number of years she might be profitably kept as a dairy cow on the average; and many other similar questions would also receive at least a partial solution.

An institution capable of doing all the work I have prescribed for it, (and much more that I have necessarily omitted) effectively, and otherwise it would be a mere sham—"a mockery, a delusion and a snare," would undoubtedly involve a large annual outlay, for it would require for its conduct the most skilful operators, the ablest chemists, the most profound physiologists, and the most highly qualified and experienced veterinarians that could be procured, and the services of such persons cannot be had without ample remuneration, while the buildings, apparatus and instruments must all be of the best, and consequently of the most costly description; and yet I have no hesitation in affirming that the benefit to be derived from such an institution would far outweigh its cost; for it must be remembered that it is not the possession of a few first-rate factories, but the uniform average excellence of its products that raises the reputation of a country above its rivals. An institution of the kind is therefore a national necessity, and ought not to be and cannot be dependent for its support upon the liberality of private individuals, but if it is to exist at all, must be maintained at the expense of the nation.

I cannot be accused of flattery when I say that the spirit and enterprise shewn by the dairymen of the United States, in establishing and maintaining by their own exertions, and at their own expense, without aid from either the Central or the State Governments, so many and so effective associations for the purpose of improving their manufacture, redounds as much to their credit as it has redounded, and must redound in the future to their advantage. But what they have hitherto done is no reason why they should be left to their own unaided resources in future. On the contrary it gives them a tenfold stronger claim upon the consideration of their rulers.

At the same time it must not be forgotten that we in Canada owe a deep debt of gratitude to our American friends for the extensive and rapid development of dairy husbandry in the Dominion; for it was by following their examples, adopting their advice, and conforming to their instructions that we have been able to achieve so complete and remarkable a success in, and so substantial a commercial result from, the manufacture of cheese. And we should also remember that it is still to their leading and representative men that we have mainly to look for further research and future improvement in the more recondite, and therefore more difficult lines of inquiry which must yet be pursued to solution, if we are to attain to that certainty and uniformity in the production of first-class articles of consumption which constitute the perfection of manufacturing skill.

But it would not be right or creditable for us to sit idle, waiting to take advantage of the superior energy and intelligence of our neighbours; and therefore such an institution as I have endeavoured to indicate is as necessary for us as for them. Our Governments, both Dominion and Provincial, are providing ample means of transport for our productions,

by subsidizing railways, and constructing and enlarging canals, with unprecedented liberality, and by-and-by they will perhaps conclude that the industries which furnish the freight that those railroads and canals are intended to convey, are at least equally deserving of encouragement.

Let us then hope that the claims I have attempted to advocate may be acknowledged and allowed, if not before, at least when statesmanship and patriotism, instead of politics and self-interest, shall become the guiding principles of Presidents and Governors, of Ministers and Legislators, on both sides of the dividing line.

DISCUSSION.

Mr. Casswell—I consider it is of great importance, as has been intimated by Mr. Craigg, Mr. Losee and others, to drill the rank and file ot dairymen, that is the patrons, in the principles and best methods of manufacture. Meetings should be held in different neighborhoods, and dairy districts, and have them addressed by such men as Mr. Chadwick, Mr. Noxon, Mr. Ballantyne, and others. These gentlemen I am sure would do all they could in that way, and I know that it would result in much good generally, and when we meet in our conventions we would find many more here capable of contributing something of interest on these subjects. I will refer to another matter. I have heard something said about the cheese fairs in a disparaging manner as though they were of no benefit, and the money expended therein wasted. This is a great mistake. I am satisfied that these fairs and exhibitions have done great good, as well as these conventions. Factorymen find that it is important to attend carefully to all the operations of manufacturing cheese.

Now, gentlemen, I will say that perhaps no one has contributed more to the advancement of the dairy interest than our friend, Mr. Farrington. His valuable services for many years, not only to our Association here, but to the dairy interests of Canada and America generally, demand our gratitude. I question whether there is in Herkimer County, or on the American continent, one better qualified or more willing to give practical information in connection with dairying. He came to Canada many years ago as a missionary in dairy matters, and who could be more willing to impart information, or devoted more of his time to that objeet than he.

I therefore move that the thanks of this Convention be especially tendered to Mr. Farrington, for his services in connection with this Association, and with the dairy interests of Ontario and in the United States.

Mr. Losee—With great pleasure I second the motion.

Prof. Arnold—I would say that I heartily approve of this motion on the present occasion. I took my first lessons in dairying from Mr. Farrington, and I am indebted to him from another cause. Mr. Farrington was my early school-master. He was just as expert a school-master as he is a cheese maker. (Applause.) I consider it especially appropriate for Canadian citizens to move such a vote of thanks on the occasion of the assembling of the American Dairymen's Association in Oxford County, inasmuch as we feel indebted to Mr. Farrington, as well as you, for the progress made in dairying in the whole territory the Association represents.

The vote was full and hearty.

Mr. Farrington—It is a great source of gratification that I have received this mark of your esteem. This hearty manifestation of your appreciation of my little services are far greater than I deserve. I have done no more than what was my duty. I thank you for your kindly expressions, and in return aeknowledge my indebtedness to the people of both Canada and the States the very valuable aid their experience and progressive wisdom has been to me in the calling which has always been, and will continue to be the business of my life.

Mr. Farrington then gave a short sketch of his more than 40 years career as a dairyman. At the close of his remarks, the President announced that opportunity would now be given for discussion on the subject of Prof. Bell's paper.

Prof. Stewart—Coming down to the basis of American institutions by putting everything into the hands of the people and if we wish to reach dairymen and benefit them by establishing experimental stations, they must be maintained by dairymen themselves.

What costs them nothing they will think little of. There is in the State of Massachusetts an institution founded by Mr. Bussy, and called the Bussy Institution. It is intended to promote Agriculture. From a bulletin of that institution lately published by our able Professor, it would appear that not one in four of those whom it was designed to benefit knew that there was such an institution.

For the Government to establish such an institution without having it brought before, and enlisting the interest of, farmers and dairymen it would only be ornamental, and would fail to accomplish its designed object. Now, I would say that this matter should be brought before the factorymen and patrons in each neighborhood and district, and each one contribute a small sum annually. These yearly contributions might be collected by an agent or manager in each district. It would not at most require more than fifty cents from each patron and factorymen to sustain an experimental station, for they are numbered by the thousand. That amount contributed by each one in N. Y. State would raise the sum of $15,000. Sustained in that way by dairymen themselves it would be something practical, and would not fail to accomplish the object sought.

Mr. Lewis—From long experience and observation I am convinced that any institution depending upon the voluntary contributions of farmers or dairymen would fail. Such an institution as an Experimental Dairy Station, I believe should be established and maintained by the government.

Prof. Arnold—An Experimental Dairy Station established and maintained by the government, would stand in a different light from that of the Bussy institution referred to by Prof. Stewart. Dairymen are differently situated. Here we have all over the country organizations made up of men constantly experimenting, and would be in constant communication with the head station. If you should get one established here, we would be benefitted as well as you, and if we would get one on our side, you would be benefitted as well as we. Points of great interest in the estimation of practical men, would receive special attention. It is for this reason that I am very anxious to see institutions of that kind established. If we had not one but many, I have no doubt they would be very beneficial.

Mr. Chadwick.—I heartily approve of this and I would urge upon you the necessity of using all the influence you possess for the establishment of an Experimental Dairy Department in connection with the Agricultural College and Model Farm.

This is an age of progress. You must acquire a certain amount of scientific knowledge if you would be successful, and I know of no more efficient mode than to have a Dairy Department in connection with the Agricultural College. There is no question but it can be done. Let the matter be urged upon the government.

On motion further discussion on this subject was discontinued.

THE DAIRY INTEREST OF CANADA.

The President then introduced C. E. Chadwick, Esq., who delivered an address on the above subject.

Mr. President, Ladies and Gentlemen,—The dairy interest of Canada is a subject with which I have been familiar since the first introduction of the factory system in the country, and we find a wonderful revolution has taken place in a few years. Ten years ago we find from the returns that Canada imported from foreign countries for home consumption some $300,000 worth of cheese.

In the short space of four years after the introduction of the factory system we exported one million dollar's worth. In 1873 it reached three millions; in 1874, four millions; in 1875, five millions: while the amount for 1876, though not yet ascertained, will doubtless be equal to, if not in excess of, the amount for 1875. Butter to the amount of two and one-half million dollar's worth was exported in 1875, in addition to the cheese, while the estimated value of the dairy products for that year was about ten million dollars. We have at the same time exported cattle largely to the old country.

This surely shows that our country is well adapted for the production of cattle and dairy produce. There has also been a large exportation of pork and beef. All this is an encouraging exhibit of the agricultural interests of our country. The results of our Centennial exhibits during the last year will be of very great benefit to us in removing the ignorance and prejudice prevailing in the Old Country and elsewhere in regard to our condition and resources. One great advantage which the dairy interest in particular has gained from the display of cheese at the Centennial was in the removal of the prejudice against Canadian cheese, on account of supposed defects in its flavor. I think I may safely say that our success in regard to the dairy at the Centennial is largely due to Mr. Casswell, whose exertions to make a good show of Canadian cheese has been so successful.

On motion of Mr. Farrington a hearty vote of thanks was given to Mr. Casswell for his exertions to secure the success of the Canadian exhibit in the Dairy Department at the Centennial.

The Convention then adjourned until 2 p. m.

AFTERNOON SESSION.

The Convention reassembled at 2 o'clock, Mr. Burrill in the chair.

The Committee on nomination made the following report which was received and adopted :—

President—Hon. Horatio Seymour, of Utica, N. Y.

VICE-PRESIDENTS—C. E. Chadwick, Ingersoll, Ont.; X. A. Willard, Little Falls, N. Y.; T. D. Curtis, Syracuse, N. Y.; O. S. Bliss, Georgia, Vt.; M. Folsom, New York city; Prof. E. W. Stewart, Lake View, N. Y.; Stephen Faville, Lake Mills, Wis.; C. L. Sheldon, Lowville, N. Y.; Thomas Ballantyne, M. P. P., Stratford, Ont.; G. B. Weeks, Syracuse, N. Y.; L. R. Richardson, Kerwood, Ont.; Dr. E. G. Crafts, Binghampton, N. Y.; W. L. Rutherford Waddington, N. Y.; A. M. Fuller, Meadville, Pa.; J. G. Cohoe, Fredonia, N. Y.; Madison Cooper, Evans Mills, N. Y.; H. S. Oaks, Cattaraugus County, N. Y.; Israel Boise, Byron, Ill.; C. F. Whittier, Minnesota; J. T. Ellsworth, Barre, Mass.; Hon. Wm. A. Johnson, Collins Centre, N. Y.; Dr. L. L. Wight, Whitesboro, N. Y.; Peter R. Daly. Belleville, Ont.; S. Straight, Hudson, Ohio; Chester Hazen, Ladoga, Wis.; Prof. L. Wetherell, Boston, Mass.; E. Casswell, Ingersoll, Ont.; Edward Norton, Goshen, Ct.; H. S. Losee, Norwich, Ont.; Capt. H. D. Gardiner, McLean, N. Y.; John Stewart, Manchester, Iowa; P. H. Burchard, Grant Park, Ill.; George Hamilton, Cromarty, Ont.; Benj. Hopkins, Brownsville, Ont.; C. H. Wilder, Evansville, Wis.; David H. Burrill, Little Falls, N. Y.; J. M. Peters, New York city; S. A. Farrington, Gilroy, Cal.

SECRETARY.—L. B. Arnold, Rochester, N. Y.

TREASURER—Hon. Harris Lewis, Frankfort, N. Y.

E. W. STEWART,
C. L. SHELDON,
D. H. BURRILL,
HARVEY FARRINGTON,
H. S. LOSEE.
} Committee.

REFUSE OF THE DAIRY.

This subject was introduced by Prof. Arnold, who spoke as follows:

The refuse of the dairy, its use and and abuse, is worthy of consideration, especially in connection with the mangement of the factory.

Its use consists in preparing it for food, which is the only use to which it is applied, unless it be as a fertilizing agent, and for this purpose it is of so little value as not to be worthy of our consideration. It may be so much better employed as food for animals, that we shall consider it in that light.

When butter is manufactured we simply take from the milk the fatty part. Our operation in this respect resembles that of slaughtering a fat ox and removing the fat alone, and giving the rest to the pigs for the manufacture of pork. The nitrogenous part of the milk, which supports and builds up the animal structure, bone, flesh, blood, is in the skimmed milk. It seems a tremendous waste to feed this to animals instead of making use of it for food for man. The great value of milk as food consists in the nitrogenous part which is in the skimmed milk. The butter or fatty part which we extract contains only one-half per cent. of nitrogenous matter. This fatty part does not nourish the body or sustain life. It is necessary as a means of supporting the heat of the body, and may aid in digestion, but whatever purpose it may serve in the animal economy it does not support life. It seems therefore an enormous waste to take that which does support life, and feed it to animals at a great loss.

We were told yesterday by Prof. Stewart, that we can get one pound of the live weight in the pig from sixteen pounds of skimmed milk. This is made at a great sacrifice. No doubt it would be worth much more, if properly manufactured into cheese. There have been many experiments made in this direction, and very valuable information has been gained. So many difficulties have been in the way and so many failures attended the past efforts that it has been a question whether the manufacture of skimmed milk cheese was not detrimental, whether it would not be more profitable to feed the milk to pigs and calves, than to make it into such cheese as it has been made into.

Lately some have become more expert and have made skimmed milk into a palatable and wholesome cheese. This no doubt can be done, but it requires a great deal of skill and patience to do it.

It requires a method quite different from the ordinary way of manufacturing cheese. I believe, however, it will not be long before those who make butter will become sufficiently familiar with the science of cheese manufacture to be able to make out of skimmed milk a cheese that will be fairly palatable, digestible, wholesome and nutritious. The great difficulty in manufacturing skimmed cheese lies in the curing of it.

If treated as in the ordinary process instead of converting it into cheese it dries down and remains to a large extent dried curd, which is insoluble in water, and insoluble in the acid of the stomach, requiring a long time to digest. It is a most important item in the manufacture of cheese to make it wholesome and digestible. If properly made and cured it almost melts upon the tongue, and is in a condition to be readily digested and is a wholesome and nutritious food. On the other hand it may be in such a condition as to be incapable of being dissolved, remaining in our stomachs a long time unassimilated. It is this circumstance that stands in the way of the consumption of cheese more than any other thing. There are thousands, both here and in Europe, who reject cheese for the reason that they cannot digest it. It gives them the headache, makes them bilious and causes all those unpleasant sensations that indigestion pro duces. We should study to present cheese in a better condition.

Skimmed milk, as I said, is capable of being made into good cheese, but is much more difficult. I will not go into the various ways by which it is manufactured. I will only say it requires an increased amount of rennet, an increased temperature, and a very skilful manipulation of the milk. It is extremely necessary to keep an even temperature in the curing room. This subject of manufacturing skimmed milk into cheese is well worthy the attention of an experimental institution. It should be thoroughly tested and investigated.

In the use of skimmed milk for animals, perhaps there is no better way than to feed it to thrifty pigs. It is not, however used to the best advantage when used alone. Skimmed milk contains an excess of nitrogenous matter, and whey an excess of the supporters of respiration, viz., sugar. In feeding milk it is necessary to have something with it to support respiration, and for this purpose corn meal is excellent.

In feeding whey we must add some nitrogenous substance. I have seen on several occasions attempts made to feed pigs exclusively on whey but they are liable to disease of the brain. There is not enough nitrogenous matter in the whey to support the nervous system, and other

tissues of the body. A little pea meal added to the whey makes an excellent food. Wheat bran or buckwheat flour added, makes a good and profitable food for calves. Prof. Stewart, who is to follow me, will probably give you more light on this subject than I can. I will now say a word in regard to the abuse of the refuse of the dairy. I will not carry this very far in the detail.

One great abuse is allowing the whey to be scattered about the floor of the factory, to drip through and collect under or outside, to lie there and taint and contaminate the air, and be carried back into the factory and be absorbed by the curd, and milk, and cheese.

This is probably the most prominent abuse, and it is a very great abuse to use it in that way. A man living in such a tainted atmosphere for a season becomes so accustomed to it that he does not appreciate it, but let an outsider approach the factory, he will very soon detect the strong taint in the atmosphere. Large quantities of the best made cheese are spoiled by being tainted with the same whey, so that it is a most serious abuse.

There are other ways in which the whey can be used to considerable disadvantage, such as feeding it to swine in the vicinity of the factory; having the hog-pen or calf-yard sufficiently near that the wind when blowing in certain directions, may easily bring the taint to the factory, and thus injure the cheese. Last summer, both in the United States and Canada, through all the hot weather, a large amount of cheese was affected by receiving these taints. It was the easiest thing in the world to point it out. Mr. Casswell can tell you with how much accuracy the different taints were pointed out to him at Philadelphia.

Question—Do you think these odors and taints from dairies have any effect on the health of the country?

Answer—There is little doubt but it does. Infection may be carried and disseminated through the air by the vapors arising from the cheese factory, as well as any other decaying matter.

Ques.—What effect will saltpetre have in destroying the taint of turnips?

Ans.—None. The effect of turnips, carrots, &c., may be driven off by heating the milk up to 145 degrees. It does no harm for cheese making so long as it remains perfectly sweet, and cures all the better for it.

Prof. Stewart—There are many farmers who regard the refuse of the dairy as of little consequence, and pay little attention to it. If they feed their animals with whey, they think that alone is sufficient. Now, if they should sit down to a table for dinner, and there should be nothing but sugar on it they would think it was rather a lean meal. When you feed a pig or a calf whey alone, you give it nothing but sugar. I would like you to see the folly in supposing that the pig can make bone, muscle and everything out of sugar.

A relation of mine built a large factory some ten years ago. There were a large number of patrons connected with it, and many of them brought their pigs there to feed on the whey, supposing that was sufficient alone. Of course they did not do well, many died, but instead of giving the proper interpretation, they said that the annatto killed them. They took them away because the whey poisoned them. He wrote to me to know whether there was any use he could put it to. I told him

that if he would put a quarter of a pound of pea meal or oil meal with a gallon of whey it would not poison his pigs or calves. He followed my advice strictly. He bought large quantities of meal and fed on a large scale. The result was a wonderful gain. My advice nearly got him into a scrape. The patrons thought he must have played a trick on them, for "your pigs," they said, "come out all right." "Well," he said, "if you had furnished me with meal to feed then yours would have come out all right too."

I have found that the whey of one cow's milk in a year, if she yields not less than 4,000 lbs. of milk (and I would not keep a cow if she did not come up to that), if fed judiciously in this way with a proper proportion of meal with it, it is quite possible for you to get ten dollars in money from the whey of that one cow. You can not do it in the ordinary way, I admit. You must feed it to young animals, and give them a full supply of food. Remember the profit comes always from the extra amount of food. I have taken pigs from four weeks old, and fed them in this way, keeping a strict account of the meal &c., reckoning no profit on that meal, and crediting all with the whey. I have received a profit of ten dollars for each cow's whey. Some people starve their pigs over winter, feeding them just enough to get them through. They do not see how much they lose in that way. If you are going to make anything out of an animal you have to feed it all it can eat. When I made this experiment with the pigs, dressed pork was worth eight cents a pound, and the pigs were sold when about twenty-six weeks old.

It is not as profitable to feed calves on the whey as pigs. They will do well and be very profitable if fed with skimmed milk or whey supplimented with corn meal, oil meal, &c. Farmers can raise their cows much cheaper than they can buy them, selecting the calves from the best cows, with proper feeding and care in twenty-four or thirty months they will be worth more than any you could buy. Those who sell do not usually sell their best.

Mr. Losee—If my patrons were to hear you say that each cow's whey was worth $10, it would set them crazy. I would be willing to sell the whey for a dollar a cow.

Prof. Stewart—Do you mix anything with the whey?

Mr. Losee—I scatter peas on the ground.

Prof. Stewart—As I told you I did not count any profit on the meal that I mixed with the whey reckoned in that way. I found a profit of $10 for each cow.

Mr. Casswell—There is no more important subject than that referred to by Prof. Arnold, in his remarks on the abuse of the refuse of the dairy. The horrid smells that arise from many factories in consequence of the whey being allowed to drip through and putrify in the air is beyond all endurance. It is enough to cause epidemics to spread over the country. The injury it does to the cheese is incalculable. I am certain that this is one of the biggest leaks in the dairy.

Mr. Ashley—I would ask, are not buyers very much to blame in this connection? They make no difference in the cheese manufactured in a scrupulously clean factory, and where every pains is taken to prevent the least smell or taint, than that made and cured in the atmosphere contaminated with these horrid smells. They will pay just as much for this

cheese as the other, and there is therefore no encouragement given to those who spare no pains and expense in removing the whey and preventing the taints. When negligent and careless factorymen can get just as much for their cheese as those who take the greatest care for the cleanliness of their factories and surroundings they are not likely to make much improvement, or go to extra expense.

REPORT OF COMMITTEE ON DAIRY UTENSILS.

Your Committee on Dairy Utensils respectfully report that they have examined Lambert's Improved Curd Mill and Curd Cooler. We recommend it for trial by dairymen.

We have also examined the Improved Union Churn and commend its workmanship and its price as reasonable. Knowing nothing of its working we cannot speak positively of its merits. The manufacturers make the liberal offer of allowing dairymen to test it before purchasing.

Frazer's Gang Press, manufactured by Ashley & Smith, is so well known that it needs no commendation from us. The latest style is a decided improvement.

The Curd Knives of Whitman & Burrill, both perpendicular and horizontal, are the best we have ever seen.

Sell's Cheese Press for private dairies seems to be compact, easily worked and cheap, but will require improvement.

Battersby's Patent Steam Boilers are so well known that they need no comment from us.

J. S. Pearce,
Robt. Tracy,
Harris Lewis,
} Committee.

[By reason of an error in writing the name of the Chairman of the Finance Committee, that committee failed to make a report.—Sec.]

The following report of receipts and expenditures by the Executive Committee appointed by the Centennial Dairy Committee was read by the Secretary as follows:

Mr. President,—The American Dairymen's Association at their Annual Convention held at Utica in the year 1873, appointed a Committee for the purpose of taking preliminary steps to represent the dairy products at the Centennial Exhibition to be held at Philadelphia in the year 1876, of which J. V. H. Scovill, of Paris, N. Y., was chosen chairman. This Committee was continued from year to year, till the Convention held in Rome, N. Y., in January, 1876, when the Committee was enlarged and organized, and proceeded actively to the business of perfecting arrangements for the exhibition.

This Committee determined to erect a model Butter and Cheese Factory, combined in one building, and to equip it, by donations and contribution, with approved implements, such as had been tested, in equipment of a first-class butter or cheese factory. At subsequent meetings held, an Executive and an Auditing and Finance Committee were appointed to whom was intrusted all the details of the exhibition.

These Committees proceeded in the discharge of duties, by raising moneys in the dairy districts, and arranging for the equipments.—Pledges were received from various localities and States to further the enterprise, as follows: Vermont was pledged by O. S. Bliss, for $1,000

and N. P. Sprague,of Brandon, Vt., pledged to donate the "Howe Scales" as part of the equiment. The total amount received from Vermont was sixty dollars, and seventy dollars was paid O. S. Bliss for expenses in obtaining the subscriptions. The scales donated by Mr. Sprague were taken from the Association, by an order from the donor. The compartment milk pans, donated by W. O. Campbell, of Richford, Vt., were also taken away from the Association, by an order from the donor.

The State of Ohio, through D. L. Pope, pledged $1,000, and they paid $500.

The State of Pennsylvania, by J. H. Reall, of Philadelphia, pledged $1,350, and paid $480.

The Canadian Commission contributed $2,000, the amount of pledge.

The New York State Dairymen's Association and Board of Trade contributed $6,543.87.

New York State subscriptions paid about $430.

L. S. Hardin, of Louisville, Ky., paid $10, making the total amount of ten thousand, nine hundred and fifty-six dollars and thirty-nine cents.

FINANCIAL STATEMENT

Of the Executive Committee of the Centennial Committee of the American Dairymen's Association, of all money received and how expended in the preparation for and display of dairy products at the Centennial Exhibition at Philadelphia :—

Received from the Treasurer and assistant Treasurer.....	$1,676 52
Received direct from contributors.....	210 00
Received wholesale price of implements exhibited.....	26 00
Received from New York State Dairymen's Association and Board of Trade	6,543 87
Received from Canadian Commission	2,000 00
Received from State Ohio.....	500 00
Total.....	$10,956 39

The foregoing amount was expended as follows :

To Wm. Blanding, for building,.....	$9,820 00
Incidental expenses for printing and expenses of committee..	1,136 39

There is $180 yet due Mr. Blanding on the building, the contract having been $10,000.00 for the building.

From a glance at the foregoing receipts and expenditures it must be apparent that without the timely appropriation of $8,000 by the legislature of the State of New York, $6,543.87 of which were used through the N. Y. State Dairymen's Association and Board of Trade, the entire enterprise could not have been saved from failure at the outset.

The general Committee early devised that the Model Butter and Cheese Factory, should be fully equipped with suitable and approved apparatus to represent all the internal features of a first-class butter and cheese factory.

At a meeting of the Executive Committee of the Centennial Committee of the American Dairymen's Association, held at Utica, N. Y., March 17, 1876, the following resolution was adopted :

Resolved,—That Josiah Shull, of Ilion, N. Y., and Harris Lewis, of

Farnkfort, N. Y., be and they are hereby appointed a committee to decide upon the merits of the necessary apparatus and outfit, including engine, vats, &c., to be placed in the Model Cheese and Butter Factory on the Centennial grounds.

No implement, machine or apparatus will be permitted to be put into the factory outfit except it shall be first-class and such as shall be adapted for general use in cheese and butter manufacture.

For the purpose of paying the necessary expense in providing space for implements, dealers in dairy apparatus and equipments will be charged the contribution of the article or articles, or the wholesale price in cash.

All freight charges on apparatus or implements, prepayment must be made by the person or persons furnishing or sending the articles; and all articles requiring skill to be set up and properly arrange in position, the parties furnishing the same, will be required to set up at their own expense or pay such expense.

All applications for space for implements in the equipment of the factory should be made to the undersigned, as soon as possible.

JOSIAH SHULL, Ilion, N. Y.
HARRIS LEWIS, Frankfort, N. Y.

April 8th, 1876.

The special committee apppointed as per the foregoing resolutions issued their circular letter and sent it to manufacturers of dairy implements. At a subsequent meeting of the Executive Committee, this Committee were further instructed to vary the terms of the contributions as in their judgment was thought proper.

The following arrangements were entered into for equipments —

George Plumb, of North Bangor, N. Y., donated a set (four) of the Gilt Edge Milk Pan.

W. H. Hyde, of Cortland, N.Y., donated a set (four) of the Jewett Milk Pan.

James C. Baker donated one double walled churn.

P. Embry & Son, of West Chester, Pa., donated Embry's Rotary Butter Worker.

The Orange Co. Pail Company, of New York, donated twenty-five of their Return Pails.

N. P. Sprague, of Brandon, Vt., donated a full set of the Howe Scales as follows :—1 eight-ton scale, 1 eight-hundred pound scale, 1 six-hundred pound scale, 2 No. 11 scales, 2 No. 9 scales.

John T. Ellsworth, of Barre, Mass., donated the value of an oscillating churn ($18.)

Mr. R. Howe, of Brooklyn, N.Y., donated the value of one of the Howe Churns ($8).

Frazer & Benson, of Rome, N. Y., donated one Frazer Gang Cheese Press.

D. G. Young, of Cedarsville, N.Y., donated two sets Curd-Knives.

Speakman, Miles & Co., West Chester, Pa., donated a Butter Packer and Butter Box.

John Mathews, of Pleasant Grove, Pa., donated the Eureka Butter Packer.

Iron Clad Can Company, of New York, donated one 30-gallon can, one

20-gallon can, one 15-gallon can, two weighing cans, two sets peddler s milk cans (6 each), four pails, three milk strainers and one skimmer.

W. O. Campbell, of Richford, Vt., donated a set (four) Compartment Milk Pans.

A Dog Power donated by St. John (not certain).

Of the foregoing list the Committee have in their possession the Gilt Edged and the Jewett Milk Pans, the Orange County Pails, Frazer Gang Cheese Press. Butter Packer and Butter Box of Spearman, Miles & Co.

The double walled churn was returned to the owner.

The Compartment Milk Pans, Rotary Butter Worker, Howe Scales, Curd Knives, dog power for churning, and Milk Cans, were carried off by D. L. Pope the Superintendent of the Dairy Section. This property carried off by Mr. Pope, was valued by the manufacturers at about $700. He took the property on pretense of having advanced about forty dollars in freight charges.

The Committee having charge of the implements had written transfers to the Association, of the Curd Knives and Milk Cans ; and of all other implements verbal transfer and by implication in accepting the terms and placing and setting up the implements, in compliance with the conditions.

The Compartment Milk Pans, donated by W. O. Campbell, had erected over the pans on the wall, a sign in large letters, "Made for the American Dairymen's Association." All donators were allowed the privilege of using the above inscription. Some availed themselves of it and others not.

The Committee feel it a duty they owe to themselves and to the dairy-public to say that they have employed the most efficient means they could to procure the money necessary to make an appropriate display of the dairy products of the country at the great International Exhibition ; that they have used the means at their command to the best of their ability for the attainment of the end in view ; and that they have, without charge, freely given much time and labor, to them valuable, in furtherance of the cause.

Having thus used their best endeavors, if all that was anticipated has not been accomplished, they feel it is not their fault.

The labors of the committee have been surrounded with circumstances which have made their position both responsible and difficult.

Raising funds for public use from citizens not accustomed to contribute to public enterprises is always difficult. Dairymen as a class are not accustomed to being called upon for public contributions, and, though generous in their hearts, more slow in responding. They seemed to require more time to consider than the exigencies of the situation would admit of, and this made the task of collecting from them the funds required a difficult one.

The very short time the committee had for preparation compelled so much haste there was hardly time for due deliberation, and the scattered location of its members made it difficult and expensive.

Whatever was done had to be done quickly or not all. In the hurry of complying with the demands of the Centennial Commissioners, some action not strictly formal was deemed necessary by such of the Committee

as could most readily assemble. Every act of this kind has been industriously used to misconstrue the motives of the Committee.

A strong opposition, engendered by personal jealousies, or disappointed aspirations in the attainment of positions or private ends, did the most to injure the dairy at the Centennial. In this connection it was extremely unfortunate for the show (if not for the individuals themselves) that men whom dairymen have delighted to honor, should, whether from personal motives or mistaken policy, prostitute their talents by using them to oppose through the press, and in every way they could, the laudable enterprise of making an exhibition of butter and cheese worthy of the magnitude of the dairy interest of the country—an enterprise for which earnest and patriotic dairymen of the States not only, but of Canada also, were working for and anxiously desiring to see go forward. If the display of dairy goods at the Centennial was not as successful as its friends desired and expected, its failure to meet their expectations is mainly chargeable to opposition of the character just alluded to.

But in the face of all the difficulties and opposition its friends have had to encounter, the dairy at Philadelphia, both in the number of its entries and their magnitude, has more than equaled the average of other agricultural industries of the country, and this certainly is fairly successful and creditable.

The Committee regret the unfinished state of their work, which prevents them from now making a complete report. By the next meeting of the Association they hope to dispose of the property they hold, and notwithstanding the loss of several hundred dollars slipped away by official intrigue, to be able to satisfactorily adjust all reasonable claim upon them, and to render a full and final report to the Association.

L. T. Hawley, Chairman.
Wm. Blanding,
J. V. H. Scovill,
L. B. Arnold,
J. Shull,
Harris Lewis.

SPECIAL MEETING AT PHILADELPHIA,

OCTOBER 17th, 1876.

In accordance with a resolution passed Januray 12th, 1876, accepting an invitation from the Philadelphia Produce Exchange, to meet at the rooms of the Exchange at the opening of the special discussion of dairy products in the fall, in connection with the National Butter and Egg Association, the American Dairymen's Association convened October 17th in Judges' Hall, on the Centennial grounds, the Hall being more convenient for the sessions of the two Associations than the rooms of the Exchange.

In the absence of the Hon. Horatio Seymour, President of the Association, the Convention was called to order by the Secretary of the Associatiation, and G. B. Weeks of Syracuse, N. Y., one of the Vice-Presidents was invited to the chair.

Mr. Weeks upon taking the chair made a few introductory remarks as follows :—

GENTLEMEN OF THE AMERICAN DAIRYMEN'S ASSOCIATION, AND OF KINDRED SOCIETIES, AND OF FRIENDS WHO ARE INTERESTED IN THE GREAT SUBJECT OF DAIRYING :—It was only yesterday that I learned that our President, Hon. Horatio Seymour, could not be present at this meeting, and I was requested to present a few opening remarks as introductory to the prepared papers and discussions arranged for this gathering. I regret as much as any of you can that Mr. Seymour cannot be with us on this occasion, but the condition of his health is such that he is less able to make journeys and give his strength to such work as this than he used to be. You will miss his rare tact and ability in presiding, and his words of cheer and wisdom in your discussions.

We are convened to consider topics relating to the great subject of dairying. The popular notion of this subject is exceedingly crude. Most men and women of good general intelligence and tolerably well read in the progress of events in the world of to-day would have no idea but that all that is known, or to be known in regard to dairying could easily be told in a couple of hours. You and I have even met dairymen who, in their own esteem, knew it all, having learned it all in a single season's experience ; but to those who have given years and years to the subject, either practically or theoretically, and by reading it seems like a stream, large, and deep and powerful, many-branched, and which promises to go on and on, swelling in power and importance through all the coming years. We are met to consider, from new points of view and new surroundings, some of the subjects bearing upon this great branch of agricultural industry, and I feel that the officers of the Association have done wisely in arranging for this gathering at this time and place. Surely, in this great

Exposition, where American progress in the first century of its existence is being illustrated and made manifest to the world, that system of dairying which has called this and kindred Associations into being has a right to assert itself and show the results, albeit it came into existence almost in the last decade of the century.

This is no time or place, nor is there any occasion to attempt to trace the history of dairying in the remote past, even in faintest outline. Since the earliest records of sacred and profane history it has existed, and it will exist, doubtless in all time to come.

It was early introduced into America, and was practiced essentially in the good old primitive ways of our fathers until within the recollection of most of us who are here assembled.

Who first originated the idea of associated dairying, the factory system, and when, it may be difficult to determine. Generally the credit for this has been given to the late Jesse Williams, of Rome, N. Y., and it is certain that if not the author of the idea (which I do not assert) he gave to the system so much of success and of prominent notice, that great numbers of dairymen became acquainted with it and a great many embarked in it. He never concealed the details of the business, and never withheld his encouragement to others to follow his example in the manner of conducting it.

Mr. Arnold in his American Dairying asserts that seven years before Mr. Williams began his associated dairy one on quite a similar principle was begun by Mr. Lewis M. Norton, of Connecticut.

That the factory system, generally speaking, is an immense advantage over the old manner of conducting dairy operations is proven in ways too numerous even to enumerate here. That the factory system has been greatly modified and improved within the past fifteen years, no one who has studied its history or been conversant with its workings will for a moment deny. That it is susceptible of further modifications and of vastly greater improvement none will question. My own introduction to the factory plan began in 1861, and my acquaintance with it has been pretty intimate from that time to this. As I look back to those early days of the system I am amazed to see how profoundly ignorant we then were of systems and principles which are now deemed absolutely essential in achieving even moderate success in the production of butter and cheese. Then we knew little or nothing of the necessity of acidity in the curd; nothing of floating curds and their treatment; nothing of that exquisite care which the careful dairyman of to-day gives to every condition of the raw material with which he has to do, and to every part of the process of converting that material into cheese and butter. Then we gravely believed that occassional sales of cheese were better than frequent weekly ones, and it was a cardinal article of faith that the cheese made after June 1st must all be held until autumn, so that the June cheese might help to sell the Sept. and Oct. make! We have reversed all that.

Then there were no books available to help the befogged dairyman nor him who, though successful wished to know more of the principles underlying the whole matter. Now we have several admirable and practical works on the subject, the latest one, by our respected Secretary being of exceptional value.

Then the agricultural press of the country gave little attention to the

subject of dairying even in a general way, and rendered almost no help at all in the minutiæ and details of the business. Now all our leading agricultural papers have their special dairy department, and many of them their special dairy editors.

Then the scientific and learned men of our colleges ignored this whole subject as being quite out of their line, as not being practical enough or as being too much so. We got no help from them. Now, our gatherings are sure to be addressed by such welcomed and honored men as Caldwell, Law, Prentiss and Brewer, and others who bring to us the results of their wide reading, their own close and accurate experiments and tests; and the benefit of their advice founded on knowledge that is beyond the reach of most of us.

Then we had but a meagre foreign demand for our dairy productions, for in quality they occupied so low a place as to make it impossible that they should be largely wanted by England or any other nation. Now the foreign demand is so large as in fact to regulate the price of all we make—so large as to load down nearly every steamer that leaves New York with thousands of boxes of cheese.

Then we had no Dairymen's Associations, with their frequent meetings, carefully prepared papers, and their equally valuable discussions. Now we have not only this, the parent Association (born in Rome, N. Y., in January, 1863, I think) but at the East, and in the West, in Canada, and in Britain, we have organizations of a like character and for a like purpose.

We have good reason for gratification and gratulation at the progress thus far made, at the high standard of excellence to which we have attained.

No other agricultural pursuit has been so improved so changed, so systematized as this.

And yet it will not do at all for us to cease our efforts nor abandon thoughts of further and larger advances. In this, as we have seen, we have every needed help and incentive. May the present meeting be one of profit and advantage to us all, and to the dairy interests of the country generally.

To our friends who are connected with other dairy organizations, to our brethren from Canada and those from abroad we extend a hearty and cordial welcome and trust that one and all will avail themselves of every privilege and benefit which is derivable from the proceedings of these meetings.

At the close of Mr. Weeks' remarks, Prof. L. Wetherill, of Boston, was introduced who then read the following address on

DAIRY STOCK ; POSSIBILITIES OF MILCH COWS :

The question that lies at the foundation of Dairy Husbandry is, How to obtain milch cows of the best, cheapest and most productive kind? The dairyman who has learned this art and practises it, with the fulfilling of the other conditions of this branch of farm industry is almost sure to make his vocation not only remunerative, but highly so, just what every dairyman desires, however indifferent and regradless he may have been or is to the conditions which are absolutely essential to his success, or in other words to find how to make this department of farming pay best.

That breed or race of cows most desired, is the one that from a given amount of feed or forage consumed shall produce the largest relative production of milk for making butter, cheese, or to be sold by the can, as is done in many milk-producing sections for the town or city supply of milk. The cow in this her practical use comes to be regarded as a machine for changing or converting forage into milk. The breed or race of cows to be used must necessarily vary according to the use that is to be made of the milk.

Good milch cows owned by dairymen are often procured by selection, purchased because good milkers, quite regardless of breed or breeding, or of race. These chance-bred cows are kept for their milk until age impairs their milking properties and then they are sold to the grazier or turned out to graze for beef. Suppose that the owner of such a herd of cross-bred selected cows should procure a good thoroughbred bull of some one or other of the well-known milking breeds of cattle, whether Shorthorn, Holstein, Devon, Jersey, Guernsey or Ayrshire, as may best suit the farm where these cows are kept—taking care that he be of a good milking strain of whatever breed is selected—a few dollars should not be grudged in getting a bull that is all right—and let him run with his cows and raise the heifer calves to replenish his herd as the old cows are turned off for beef. How long is it supposed it would thus take in this way to make a very choice herd of milch cows? Not many generations, as both experience and observation have taught many of the dairymen of the United States and Canada. There are many such herds of cows that I have seen in some sections of Massachusetts, Vermont, New York and the West. There are in the aforenamed States many herds of such cows that can hardly be distinguished from thoroughbreds, Ayrshires, Jerseys, Devons, Holsteins or Shorthorns. Such herds can be named, were it necessary to confirm the advantages of such a practice in breeding. To such as cannot afford to purchase thoroughbreds of any breed to begin with, as most young farmers are unable to do, such a method of breeding as suggested may, as it often has done, prove very advantageous to young dairymen. It is not proposed to treat the principles of breeding exhaustively now, but to touch only upon the subject by the way of practical hints and suggestions.

Pedigree breeding is the business of the few, and but few of these succeed in making it profitable. As a rule the prepotency of the male of pure bred stock greatly preponderates. Therefore having good cows spare neither time nor money in procuring the right sort of a bull, making sure always that he is of a renowned milking ancestry. Milking qualities like other good or bad qualities are hereditary, and therefore transmissable. The quality of milk production may be bred out, as it were, and as it has been done in some of the families of Shorthorns, while the breed for nearly a thousand years has been known, as it still is, as distinguished for its great milkers. Forcing or abnormal growth may destroy the milking qualities of any breed of cows so that it may make it necessary to provide foster-mothers to raise the calves of such high bred cows.

The knowledge of the laws of breeding are still quite important, especially as they relate to crossing. Yet enough is known to demonstrate its great utility in some cases and its utter failure in others. In regard to Shorthorns, such bulls as Hubback, Favourite, Kitton First, Belvedere,

Duke of Northumberland, Earl of Dublin, were all remarkably prepotent in their influence on their progeny. The last named bull impressed deep milking qualities upon all his get, this being due as it was claimed to the influence of the Princess blood that was inherited by and characterized this noble bull.

The period of the year when cows should calve deserves a passing remark. If the object be both rearing calves and dairying, the cows should drop their calves from the middle of December to March; if for cheese-making, regardless of calf-raising, from March to April, if for producing milk for the market the cows may come in at any time when desired to keep up the average milk supply. The difference between the wintering of a calf dropped about the first of January and one dropped in April or May, both being cared for alike is greatly in favor of the former.

Both experience and observation favor the breeding of heifers designed for milch cows at an earlier age than three years or upwards, as practised by some dairymen. Heifers dropped from Christmas time to March should drop their first calves when about two and a half years old and if not fully up to the size desired, then let them go farrow one year. Heifers thus bred almost invariably make better cows than those that do not drop their first calves until three years old and upwards. Those that have dropped their first calves at the age of fifteen months have taken the first place among first prize cows. Before calving, a cow should be turned loose into a box stable or shed. Feed with good hay but do not add corn, or linseed, or cotton meal, or shorts, even if the cow be a great milker. After calving give warm gruel with Rouen or good sweet hay, for three or four days. If there be any danger of milk fever a moderate aperient which tends to promote excretion should be given. Linseed oil is useful for this purpose, and safer than salts and sulphur. Cleansing drinks should be given in case the cow does not clean timely and properly.

Periodically or endemically, cows abort or slip their calves prematurely, an evil that has not satisfactorily been accounted for nor cured. This has been charged upon food, upon local causes, and yet it has been found upon close and professional inquiry and examination to occur under a great diversity of feeding management and locality. It is the common advice that a cow when she slips her calf untimely should at once be removed from the herd and be kept apart from them for some time, and if bred again should, before doing so, be kept farrow for a year. Unless the diseased cow be thus removed, half the herd may abort within a few weeks. Removal is considered prevention.

The statements of the possible productions of cows may tend, and can hardly fail of doing so, to arouse the attention of sluggish, indifferent dairymen to the importance of giving more attention to the subject of the annual yield per head of a herd of cows, as well as of the kinds of cows to be kept. It will be observed by the following statements that great milkers are not confined to any one breed, but are found among nearly all the different breeds of milch cows, both with and without pedigree, the word being used here in its strictest technical sense as understood by breeders. I shall first call attention to Ayrshires:

"Lady Kilburnie," an imported cow and owned by Sturtevant Bros., Massachusetts, gave in one year 7,429 pounds of milk, equal to 3,455 quarts; her weight was 850 pounds. "Georgie," owned by the same,

gave 8,271 pounds of milk in a year (she was dry 22 days) or 3,847 quarts, and her weight was 1080 pounds. "Jean Armour," imported by H. H. Peters, of Massachusets, gave for ten days in June, an average of 52 pounds a day; her largest yield was 58 pounds a day, and 14½ pounds of butter a week; her weight was 960 pounds. J. R. Rendall, of Massachusetts had two Ayrshires, "Minnie" and "Clover"; the former gave 51½ pounds a day for a week, and the latter 53¾ pounds a day for a week. Wm. Crozier, of Long Island, had an Ayrshire, "Beacon Belle," an imported cow, that gave in Scotland 36 quarts, beer measure daily, (equal to 43 quarts milk measure) 92½ pounds a day, as affirmed before a Justice in Scotland.

Of Jerseys, a heifer, "Mulberry 2d," three years old, owned by McKee, gave milk on grass that made 13¼ pounds of butter a week. "Myrtle." owned by Thos. Fitch, of Connecticut, made 15¾ pounds of butter a week. "May Day, owned by J. S. Monroe, of Massachusetts, averaged for June and July 43 pounds of milk a day, that made 15 pounds of butter a week. "Maggie Mitchell," owned by the late M. T. Tilden, of New York State, gave 7,500 pounds of milk in a year, and had given 38 pounds a day, and made 18¾ pounds of butter a week. Her weight was 1,020 pounds. "Lady Milton," owned by J. C. Converse, Massachusetts, gave the first week in July 35½ pounds of milk a day and made 18 pounds of butter a week, and for 18 weeks averaged 15-92 pounds of butter a week. "Flora," imported and owned by Thos. Motley, Massachusetts, made 511 pounds 2 ounces of butter in fifty weeks, averaging 10 1-5 pounds a week, kept on ordinary feed. "Pansy," owned by J. H. Sutliff, of Connecticut, made 574 5-16 pounds of butter in a year. D. G. Roberts, of Massachusetts, has a herd of eight young Jerseys, that in 1875 averaged 239 pounds of butter per cow. The same herd (eleven cows) in 1876 averaged 245 pounds of butter. In the former year the average quantity of milk for a pound of butter was 20¾ pounds, for the latter year it was 20.43 pounds. A herd of 14 Jerseys, owned by Ed. Burnett, of Massachusetts, in 1876, averaged 5,625 pounds of milk, or 2,616 quarts per cow; the largest yield was by "Pink 3d," 8,332 pounds; "Pink 4th," 8,071 pounds; "Julia," 7,723 pounds; "Susie," 7,473 pounds; "Mat," 7,276 pounds. The record of a Jersey in England shows 19 pounds of butter a week.

Of Devons, "Gem," owned by E. H. Hyde, of Connecticut, made 15¾ pounds of butter a week, and had made 2¾ pounds a day, at the rate of 19¼ pounds a week. Coleman, in his "English Agriculture," reports a Devon cow that produced 21 pounds of butter a week. "Helena," owned by C. S. Wainwright, of New York State, gave 22 quarts of milk a day and made 15 pounds of butter a week.

Of Shorthorns, "Oxford Lass," a Bates Shorthorn, owned by Jonathan Talcott, New York State, gave fifty pounds of milk a day; "Violetta," owned by the same, gave about sixty lbs. a day, in the best part of the season; he also reports fifteen lbs. of butter a week, for his best Shorthorn cows, "Flora," a Hard-book animal in Ohio, gave 10,452 pounds of milk in a year, and made 445 lbs. of butter. "Rosa," another Ohio Shorthorn gave 11,705 lbs. in 1873; "Maid of Athol," gave 58 lbs. of milk a day for ten days, making butter at the rate of 14¾ a week; in 1874 she gave 12,875 lbs. of milk, and made 513 lbs. of butter. A cow kept by a man

in England gave 10,578 lbs. of milk, which made 540 lbs. of butter. "Sonsie," owned by Gen. N. M. Curtis, of Ogdensburg, N. Y., gave from the middle of August till Oct. 4 a little over 40 lbs. a day. In a week, beginning October 4, her daily average was 37 2-7 lbs., with 16 per cent. cream, by the cream gauge. One of Charles Colling's Shorthorn cows gave 26½ quarts at a milking; another gave 24 quarts a day ,and another 19 quarts; Bates' famous Duchess gave 14 quarts at a milking. These are all high bred Shorthorns. These were all beer quarts; wine to beer measure is as four to five.

Coleman in his European Agriculture reports a Leicester or Yorkshire cow that gave 44 quarts of milk a day, Mr. Coleman being assured of the credibility of this statement. At a milk producing establishment he reported that the average annual yield per cow was 8 to 10 quarts a day. at another establishment where Yorkshire cows were kept, the daily yield was 16 quarts per cow. These wonderful messes of milk by Shorthorns might be continued, but neither space nor time will allow it nor is it necessary to prove that the Shorthorns are great milkers.

Of Holsteins, Prof. Geo. H. Cook, of the New Jersey State Agricultural Society, wrote in 1871, relative to cows as he saw them in Holland immediately after calving, which gave from 25 to 32 quarts of milk per cow daily. He mentioned one dairy in Beemster that gave 18.6 quarts per cow daily; another at Haarlem, where the best cow gave 17.8 quarts daily for 44 weeks, 11,707⅙ lbs. or 5,482 2-5 quarts of milk per cow. To show more fully the productiveness of cows in Holland. Prof. Cook further remarked that in 1864, the number of cattle in Holland was 1,333,887, of which 943,213 were cows; of butter 32,000,000 lbs., and 61,000,000 lbs. of cheese were exported 1864. The populatiod of New York State was then about the same as that of Holland, and the whole number of cattle was 702,000. The amount of butter exported from the United States from June in 1869 to June, 1870, was 2,039,488 lbs.; and of cheese for the same time 47,296,323 pounds. The late W.W. Chenery of Belmont, Mass., near Boston, reported his imported Holstein cow, Texilaar that gave from May 26, to July 27, a period of nine weeks, 4018 lbs. 14 oz. Her largest yield 76 lbs. 5 oz., or 35⅛ quarts in one day, and for ten days she gave 744 lbs. 12 oz., an average of 74.47 pounds per day; her milk showed 22¾ per cent. of cream by a cream gauge; the milk of six days made 17 lbs. 14 oz. of good butter. A paper was comunicated to the department of Agriculture, Washington, from the Royal Academy of Agriculture, Prussia, written by Dr. Rhudes, of the Agricultural Academy at Eldena, from which the following statements were obtained: the herd consisted of 36 cows, and in 1865 a record of nine of these superior cows was kept, showing a yield respectively of 4,960 quarts, 4,710, 4,620, 4,490, 4,365, 4,800, 5,016, 5,009, and 4,900 quarts, or an annual average product of more than 4,700 quarts per cow, an average of over 1,086 lbs. of cheese annually per cow, with the maximum yield of the best cow reported to have been 1,144 lbs. of cheese. The above statement should furnish the cheese dairyman "food for thought," when the average of our dairies does not exceed 500 gallons of milk a year, says Lewis F. Allen, of Black Rock, N. Y., who adds, the average of cheese dairies is only about 350 lbs. per cow, and of butter dairies only 150 lbs.; and others have put these several

averages at a less annual product per cow, and the latter are more nearly right both according to my observation and knowledge of dairy literature.

"Dowager," a Holstein cow, owned by Gerrit S. Miller of Peterborough, N. Y., produced in 365 days, 12,681½ lbs. of milk. "Crown Princess." gave 74½ lbs. in a day, and 2,081 lbs., in a month; her average per day for six months was 50½ lbs. Topsey, two years old, gave 40½ lbs. milk per day.

John H. Cower, Goshen, N. Y., imported the Holstein cow, "Anna," weighing 1500 lbs. Her record of milk for eight months was as follows: November, 1874, 1,387 lbs.; December, 1,395 lbs.; January, 1875, 1,418 lbs.; February, 1,206 lbs.; March, 1,368 lbs.; April, 1,331 lbs. May, 1,349 lbs.; June, 29 days, 1386 lbs. Eight months' product 10,840 lbs. of milk.

Thus much for thoroughbreds. In respect to cross-breds, or grades as they are popularly called, a few reports are added: A grade Devon is reported as giving 60 lbs. of milk a day. A. A. Moore, East Berkshire, Vt., reported a cow three-quarter Shorthorn, and one-quarter Ayrshire that gave 60 lbs, of milk a day, and made 16 lbs. of butter a week. The famous "Oaks Cow," of Danvers, Mass., made 19¼ lbs. of butter in a week, and averaged 16 lbs. a week for months; her largest milk yield was 44½ lbs. a day. A cow kept in Lewes, England, gave 10,578 lbs of milk in a year from which 540 lbs. of butter were made. A ⅞ Jersey, and ⅛ Ayrshire cow, owned by Henry Saltonstall, Peabody, Mass. gave 13,065 lbs. of milk in one year; her largest yield was 60 lbs., or 28 quarts a day, S. Crosley, of Lowell, Mass., had a grade cow that gave 58 lbs. of miik a day for the month of July. "Old Creamer,' a grade Shorthorn according to the best information that I can obtain, as reported gave 102½ lbs. of milk in a day an average of 96 lbs. or of 45 quarts a day for the month of June.

I give "Old Creamer's" pedigree as found in the Jefferson County *Journal*, with her production of milk as it was published on March 14, 1877. Gen. Hungerford, of Adams, bought her, on the representation that she was part Ayrshire and part Shorthorn. He has never maintained she was thoroughbred, but that she was ⅞ Ayrshire and ⅛ Shorthorn, as she was sold to him for, and her profile tends to confirm that idea. We give "Old Creamer's" record for four days in June, 1873, when she made her famous yield of 400 lbs of good milk in four days. with the dates, hours of milking and weight of each milking, just as we published it in our columns at the time, and which Mr. Hungerford and the man who cared for the cow are willing to verify under oath.

1873.	7 A. M.	12 M.	5 P. M.	Total.
June 10th	33 lbs.	31½lbs.	33½lbs.	98 lbs.
June 11th	33¼	33¼	34	100½
June 12th	32¾	34¼	33	100
June 13th	33	34	34½	101½
Four days	132	133	135	400

It is true the yield of milk is enormous, so that even many who saw the cow, large as she is and with an udder perhaps larger than any cow living, doubted the story until they went and saw her milked and saw the

milk weighed. Mr. Hungerford's neighbor, John C. Cooper, President of the Agricultural Insurance Company of Watertown N. Y., was a disbeliever, and on June 13th he went at noon and saw her milked and saw the milk weighed, and also was present at the milking in the afternoon, at one of which milkings the product weighed 34 lbs. and at the other 34½ lbs. He with many others who witnessed the milking and weighing at one time and another became thoroughly convinced that "Old Creamer" did just what it was stated, gave an average of 100 lbs. of milk per day. Now as to her feed. "Old Creamer" will not now and never would drink milk, and never has drank a pint of milk since Mr. Hungerford has owned her. At the time she made her wonderful record she was fed four quarts of ground oats and bran mixed half and half, three times per day. She was up to her eyes in clover and had all she could wish to eat, and there is every reason to believe that she performed just what was claimed for her which opinion the people of this vicinity hold and are convinced of its truth.

A. Scott, of Craftsbury, Vt., reported a "Native" cow 9 years old, in 1876. that made 42 lbs. of butter in 14 days, at the rate of 3 lbs. a day. The first four months while in the barn she made 289 lbs., and in the 8 months following she made 500 lbs. At the end of the year, twelve months she made 633 lbs. A few years ago he had a cow that made 504 lbs. in a year. The former of these cows was fed on hay made of early cut grass, in winter with four quarts of potatoes night and morning, with pasture range in summer, as reported. Another native cow, six years old, in twelve months gave 5100 quarts of milk, 10,965 lbs., averaging about 14 quarts a day for the year. The milk was sold for six cents a quart, amounting to $312.60; the calf when four weeks old sold for $9, making a total of what was sold from this cow in one year, $315. The authentic record of a cow in Sussex, England, showed a return of $365 in gold for one year.

Thus have I at some length shown the possibilities of cows among thoroughbreds of the different races and breeds of cattle from well authenticated statements; also of cross-breds and what are called "natives."

According to the late census returns of Mass. for 1875, the average daily product for 126,034 cows was 5.41 quarts of milk, an annual average per cow of 1974½ quarts or 4255½ lbs. per annum. The average yearly returns per cow was $53.60, from which must be deducted the cost of feeding and taking care of the cows per head. According to United States census for 1870, the average milk yield per cow through the year for Massachusetts was 4 quarts per day; Vermont, 4.10 quarts per day; New York 5½ quarts; Michigan, 3.41; Iowa, the Centennial butter medal State averaged but 2.44 quarts of millk per cow; Indiana, 1.93 quarts; Illinois 2.36; Missouri, 1.20; these four States last named own one-fifth of all the cows in the United States, which average but 2.12 quarts daily per cow. No wonder, from this view, that the American dairy business fails to pay liberal dividends to those who are engaged in dairy husbandry.

Every dairyman knows, as every breeder of thoroughbred dairy stock will admit, that over the United States and Canada, probably not one per cent. of the milch cows are thoroughbreds, including Ayrshires, Devons, Holsteins and Shorthorns, the most common of the imported

thoroughbreds, and, as has been noticed, the best for dairy purposes. Allowing one per cent. for thoroughbreds, and nine per cent. for cross-breds, that are half-bloods by crossing thoroughbred bulls of the aforesaid breeds with the nondescripts commonly called "natives," some of which cross-breds, ay, many of which are good milch cows, and that leaves 90 per cent. of "natives" which go to make up the dairy herds of the United States and Canada. "Of this 90 per cent. of 'natives,' they fall below giving three times their live weight of milk per annum," says Prof. Arnold in his work on American Dairying. The same writer says, "An average herd of thoroughbred Ayrshires fairly fed and cared for will produce six times their live weight (which is almost 1,000 lbs. per cow) in a year, while there are cows of this breed that will do very much better, and it is doubtful whether any other breed will make as good an average in proportion to their weight. Their milk requires from 20 to 25 lbs. to make a pound of butter. The Jerseys, if well fed produce five times their live weight per cow—annually. It requires 18 lbs. of their milk to make one pound of butter, [Jersey cows average in live weight from 700 to 900 lbs. and upwards.] The Holsteins will produce from $3\frac{1}{2}$ to 4 times their live weight (1500 lbs. per cow) per annum in milk." Take "Dowager," Gerrit S. Miller's Holstein cow that produced 12,681 pounds of milk in a year, (her weight 1500 lbs.) making $8\frac{1}{3}$ times her live weight in milk per annum, thus greatly beating the Ayrshires set down by Prof. Arnold as "the highest producers of milk of any breed in proportion to their weight." Shorthorns will equal the Holsteins in the ratio of milk production in proportion to live weight.

Do not lose sight of the statement of Prof. Arnold, that 90 per cent. of the dairy stock of the United States and Canada fall below the production of three times their live weight of milk, while thoroughbred Ayrshires produce six times their live weight of milk annually, Jerseys five times their live weight, and Holsteins $8\frac{1}{3}$ times their live weight while at the same time they are one third heavier than the Ayrshires, and more than that when compared with the Jerseys. The same that is true of Holsteins in regard to milk production is alse true of Shorthorns.

Charles M. Beach, near Philadelphia, made a careful experiment which he reported as follows: He took three pure Jerseys, three grades and three "natives," and carefully conducted his experiment for one week. The cows were essentially in the same condition, and were fed on the same kind of food. Each lot averaged about the same time from calving. It was found that to make one pound of butter the following quantity of milk from each group of cows was required :—

Of 3 pure Jerseys it took	$6\frac{1}{3}$	quarts.
Of 3 Grades,	"	$8\frac{1}{4}$	"
Of 3 "Natives,"	"	11	"

The terms, "Natives," "Grades," as ordinarily used, I have learned from observation and conversation, signify "cross-breds," where the breeding and blood of the bull is known, while that of the cow is entirely unknown, a nondescript, indescribable, that cannot be classified as to blood, breeding or definite ancestry. Such cattle are called "Natives," and when used as defined above, it signifies a large class of the stock both in the United States and in Canada—90 per cent. Says Prof. Arnold, I have not unfrequently seen pens of cattle on exhibition at

cattle shows labelled "pure natives," when it was manifest to all who had the slightest acquaintance with the different races and breeds of cattle from the British Isles and Europe, that they were cross-breds easily traced to their progenitors. Such cattle are "natives" in the sense of the term as I have defined. Cross-breds or mongrels, as they are called by some, as demonstrated by the foregoing statements, are often good dairy stock. No dairyman should fail to remember, however, that he is indebted to thorough-bred bulls of milking ancestry for this improvement.

I heard an old dairyman of Herkimer County say, that in that old famous dairy section about one third of the cows kept in that County did not pay the expenses of keeping; that another third just about paid the cost of keeping; and that from the other third came all the profits that accrued from dairy husbandry. Notwithstanding this low estimate of the average cow in Herkimer, by one old dairyman, another dairyman equally intelligent and well known in the same county, informed me that he had averaged 800 lbs. of cheese per cow in the dairy season for a series of years, and in one season his average was upwards of 900 lbs. per cow. These cows were cross-breds, the improvement thus made come from the introduction of Shorthorn bulls of milking tribes of this famous breed of cattle.

My purpose in presenting this view of the subject assigned me, viz., "Dairy Stock," adding thereto, "The Possibilities of Milch Cows," was and is to awaken an interest among dairymen; and I concluded that I could not do it more forcibly and effectively than by presenting such a view of the subject as should enable them to contrast what they have been doing from year to year, with the posibilities that are within their reach, as demonstrated by what others have done under like circumstances. I trust and hope that the foregoing statements collated with care from what are deemed trustworthy sources of recorded results among milk producers, may awaken a deep reformatory interest among the dairymen of the United States and Canada in the work of improving their dairy stock. Skilful breeding and feeding of dairy stock lie at the foundation of this improvement.

Members of the American Dairymen's Association,—Will you inaugurate this work of improvement in breeding and feeding your dairy stock, those who have not already done so, or will you continue in the traditions of your ancestors? Time will reveal your answer to this question I trust in favor of Progress and Improvement.

DISCUSSION.

Prof. E. W. Stewart of Buffalo, N. Y., was the first speaker. He said in his experience the male always transmitted improvements in stock, while the female should be selected in breeding for her conservative qualities. Dr. Sturtevant of the *Scientific Farmer*, remarked that there was an unfounded prejudice among dairymen and farmers. He said he didn't like a large cow; 900 lbs for an Ayrshire and 1200 lbs. for a Holstein was as heavy a cow as he wanted. He found this to work most economically. Harris Lewis, of Herkimer Co., N. Y., said large cows are not the most practicable in a hilly country. He thought there was no better and more profitable or cheaper scope for improvement than by cultivating our native cattle. This object could be accomplished best and cheapest by

selecting a pure male and the best of the native cows for breeding purposes. He used Shorthorns because his farm was well suited to them. Under some other circumstances he would prefer some other breed. There was use for all the breeds,—even the natives had their uses. The Alderney milk he thought would not be profitable to sell in the city markets nor to carry to a cheese factory, is too rich to compete with milk which, when it gets to the consumer is ⅓ water, and there is no justice in mixing it with the milk of common cows for cheese where all the milk goes in by weight.

Mr. Arnold explained that the Alderney milk, when used separately for cheese, had been found to be quite as profitable as the larger yields from other breeds. Bonfoy of Herkimer Co., N. Y., said it is wellknown that beef characteristics were of very much easier attainment than milk characteristics. Lewis remarked that, in his experience, if ever in the life of a cow there was a period of excessive fatness that cow was ever after prone to the secretion of fat, to the detriment of milk. Whenever he had such a cow he turned her right over to the butchers, and supplied her place with a good milker,

There was also an abatement of the milk giving tendency by disuse—in allowing cows to dry up soon after coming in.

Mr. Burchard, of Illinois, asked if feeding cows heavily on corn would be likely to injure them for future usefulness?

Mr. Lewis replied that there was risk of injury. This quesrion was further discussed by Messrs. Bonfoy, Burchard and Lewis.

Prof. Stewart compared the nutritive and respiratory matter in the different grains, showing that corn was not so well adapted to the production of milk as some other kinds of food, such as oats, oil meal, bran, etc. He related an interesting account of an experiment in producing a large frame by feeding a calf with bone forming material, and afterward with loading it with fat and flesh by selection of food.

Dr. Sturtevant read a statement embodying some very peculiar results in the milk from the different teats of the same cow.

Other speakers participated in the discussion, which was prolonged till adjourned to meet at 2 p.m. next day.

On Wednesday, the second day, Leander Wetherell was called to preside as one of the Vice-Presidents. The first talk was by Harris Lewis, on "Butter Making."

Mr. Lewis opened with the remark that good butter is sometimes produced under a great variety of circumstances—because each observes some of the cardinal principles required in the art. One for example produces milk of extraordinary quality; another provides a choice milk room; another has the advantage of superior spring water; another with inferior advantages is extremely expert in observing the changes in his milk and cream and adapting his treatment to them; while still another is exceptionally cleanly. Each excellence overrides the opposing defects and secures fair results, but they must all be observed in making gilt edged butter. He then proceeded to describe his own practice by which he secures a very choice product. He does his milking at regular intervals—5 a. m. and 5 p. m.—and each milker always milks the same cows and always in the same order. Order is said to be Heaven's first law. It is, at any rate, so fundamental that the lower animals—cows in particular—

like to observe it. This course makes the spaces between milkings just 12 hours, which would not be the case if the same order was not observed at each milking. I consider it important that the milking should be done quickly and quietly. Kind treatment is of the utmost consequence in getting good milk and good butter. Fear and affection have opposite influences in milk secretion. The latter assists in making the secretion perfect. The former always injures it and sometimes to such an extent as to make it absolotely unhealthy, and even poisonous. I would not have a brutal milker in my yard if he would work for nothing.

The milk as soon as drawn is strained through a muslin bag into Jewett pans, which are large enough to hold the whole of a milking of my 31 cows, and not be more than six inches deep. In hot weather I turn cold water round the pans and cool the milk down to sixty degrees, and if it is very warm I use ice and cool down to 58. In cold weather I cool to 65 only. The milk stands 46 to 47 hours before skimming, provided it does not begin to sour before that time. I make it a point always to skim as soon as acidity is apparent. I take one-third of the bulk of the milk as cream, and let it stand 12 or 24 hours, till it all becomes of the same condition. If in this time it is likely to get much sour I stir in salt. Cream which is just a little sour churns easier, makes the more and the better and longer keeping butter than to churn sweet or much sour.

I have a choice in churns. It is a singular circumstance that the oldest churn in use—the old dash churn—was made on correct principles. It is as good as any in use now. All churns operating by friction injure the grain of the butter and no remedy can restore it. There are other churns which work on the same principle as the dash churn and do just as well and work easier. I use the Oscilating churn. Butter should not be churned too soon. Too quick churning makes poor butter; churned in three minutes it is worth three cents a pound; in 30 minutes, thirty cents a pound. On no account would I put off churning longer than till the cream gets slightly acid. If I had not cream enough for a churning I would make the bulk large enough by putting in more milk. It is a good plan to have a good deal of milk mixed with the cream. The more the better. The whole milk may be churned with advantage. The propriety of doing so is only a question of power.

I consider it a matter of much importance not to allow the butter to be formed in a mass in the churn—that is it should not be *gathered*. To prevent gathering I stop the churn just before the butter is ready to form into a mass, and by turning in cold water reduce the contents of the churn to 55 or 56 degreess and then finish the churning very slowly. By so doing the butter in very small lumps, or as we call it, *in a granular form*, varying from the size of peas down to grains of wheat, or smaller. The temperature at which I churn varies from 58° to 64° according to the weather—in the hottest weather at 58, in the coldest at 64. In one case it grows warmer by churning, and in the other colder, so that the mass is about 60 when done. At this temperature (60) butter will not form in grains in the churn. It is so soft the granules will stick together and "come in a lump. Hence the necessity of cooling down to 55 or 56 —at this low temperature it will form into granules which will be so hard they can be handled without adhering, and as the inside of these little

lumps is entirely free from butter milk without any kneading, I regard this as a matter of great importance, for it not only saves the labor of working the butter milk out, but it avoids the injury to the texture of the butter in separating the butter milk. When the mass in the churn has been cooled and the butter formed into granules, I draw off the butter milk and churn the butter a little, slowly in cold water or brine, and this does the washing perfectly. The water or brine turned into the churn should be quite cold and enough used to fill the churn about as full as it was before the butter milk was drawn out. If the churn is not fitted for drawing off the butter milk, the butter may be skimmed out and put into a separate vessel of cold water and washed by stirring with a spatula or a common butter ladle. To remove the granulated butter from the churn after working, I use a wooden dipper or ladle with holes in the bottom like a skimmer to let the water drip away, and lay the butter on an inclined butter worker so that the water may drain away from it. This done I *stir* in an ounce and a half of salt for each pound of butter, This I find salts the butter just one ounce to the pound, the extra half ounce being carried away by the water which sticks to the butter. This is about right for people living inland. Those living near the sea require a little less salt. I find I can *stir* the salt in quicker and more evenly than I can *work* it in, and thus by *granulating* the butter in the churn instead of *gathering* it, I have the further advantage of salting without any working. After standing for about six hours for the salt to strike in, and for the butter to assume a temperature of about 60° (the proper temperature for working butter) a little pressing brings it to a solid mass and expresses the excess of brine, and the buter is ready for packing or for market. An inclined slab and lever are used for this purpose. Butter thus made has a grain to it so distinct that at 60 degrees it will break with a distinct fracture like cast iron, and it will have a fresh and rosy flavor and a keeping quality that does not belong to butter which is worked to get the butter milk out, and worked to get the salt in, and then worked again to get the brine out, and a good many work it a fourth time when packing by pawing it round with a ladle. When butter is packed it should be *pressed* to its place and not pulled about, or even smoothed down with the ladle.

I pack my butter in wooden tubs because I have nothing better. We lack a suitable butter package. We want one that will not readily feel the effect of changing temperature, that will not be affected from soakage, that will be air-tight, that will be light and neat, and so cheap as not to require returning if it has far to go. In the absence of such a package the wooden one is as good as any one we have. It does very well if it is properly prepared. A great deal of butter is injured and some spoiled by not properly preparing the wooden packages before using. The sap and woody taste should all be removed from it before receiving the butter. This can be done by soaking in boiling hot brine, or, if steam is at hand, it can be cleansed perfectly by a very short application of superheated steam. Water alone, either cold or hot, will not do it, nor will cold brine extract the whole of the flavor from the pores of the wood.

Ques.—You spoke of varying the degree for churning from 58 to 64 degrees to meet the varying temperature of the room, so that when the work is done the contents of the churn would be at 60 degrees. If the

temperature of the churn room was at 60 degrees, or just what you desired for churning, would you under all circumstances churn at the same temperature?

Ans.—No. The colder the milk and cream have been kept, the higher the temperature of the churning, and *vice versa.*

Ques.—What is the temperature of the spring water used for cooling your milk?

Ans.—I have no spring water for my milk room. I have a cistern in the cellar under the milk room which receives the water from the roof and cools it to the temperature of the cellar which is 60 degrees. The water from the cistern is pumped up into a reservoir a little higher than the pans containing the milk, and when desired is spouted under the pans and then passes back into the cistern and again cooled.

But little cooling is needed as my dairy room is well protected against both heat and cold. Its walls are tight and double with a dead air space of 5 inches between. It is so protected against heat that when cooled by the night air, and closed by day, it keeps quite cool and with little variation. I set the milk shallow so it cools readily. My pans are 7 inches deep but I never fill them over 6 inches deep, and generally not so deep as that. I would as soon set the milk deeper if I had cool spring water.

Ques.—What do you think of Mr. Hardin's method? I think it is a woman-killer. It is such hard work to lift the pails in and out of his cooling cupboards. I tried it and laid it by. I got more cream by it, but no more nor any better butter than I could get with much less labor by using large pans.

Ques.—Is there any difference between the cream rising first and last in regard to quality or churning?

Ans.—The cream which rises first churns the sooner and makes the better butter.

Adjourned to Thursday.

On Thursday met at 2 p. m., Vice-President Wetherell in the chair. An elaborate paper was read by Dr. Sturtevant on the "Philosophy of Dairying.

PHILOSOPHY OF DAIRYING.

BY E. LEWIS STURTEVANT, M. D., WAUSHAKUM FARM, SOUTH FRAMINGHAM, MASSACHUSETTS.

The era of associated dairying first inaugurated by Jesse Williams, of Rome, N. Y., in 1851, has had a remarkable developemental effect upon the dairy interests of the country. From a pursuit considered but as an incident of farm practice, the manufacture of milk has become a leading industry in which a large capital is invested, and an enormous product of manufactured goods turned out. In 1851, but one factory in operation in the country, using the milk of but two dairies, and receiving a fancy price of seven cents a pound for its cheese. In1861, the factories had increased to fifty-six. In 1864, we have record of the increase to 402. In 1866, the number had increased to 500. In 1871, to 1281. In 1876, according to the estimate of L. B. Arnold, the number of factories in operation is 4500, the number of cows tributary about 1,000,000, and the cheese production about 180,000,000 pounds. During this

interval, from 1851 to date, the price of cheese has been, at times, at twenty-eight cents a pound, or four times what Mr. Williams received.

Such a rapid and exceptional growth could not but have an influence on the farmer, and hence a corresponding increase in dairy farms, and a rivalry amongst producers. Instead of the former home market at the nearest grocery, for the cheese of the farm, the produce of the factories sought central markets and points of distribution. A new class of factors sprung up, who bought in large quantities, and attended to the distribution of the factory yields, and thus gave a general tone of steadiness to the market. At times, however, there has appeared to be an overproduction, but this mainly, perhaps, from the quantities of poor product forced upon a sensitive market. At such times, when poor cheese has been a drug, those factories which had a reputation for a cheese of an extra quality found quick sales and a satisfactory profit, and soon it was generally recognized that the higher success attended the better practice.

At the annual meeetings of the Dairymens' associations, organizations which sprung up from the mutual dependence of dairy interests, large numbers of the most progressive factory men and milk raisers, met and discussed methods and practices, and around these as a nucleus clung manufacturers and patentees of dairy utensils, and dealers in dairy stock and produce, and from this intercommunion it soon became widely realized how much benefit to practice was derived from intelligence. It was found that the mere telling of practices which were claimed as successful by some, and denied by others, was of account in enabling the difficulties to be met and overcome, but that facts were needed, and a special intelligence directed to their study in order that the *reason why* should appear. Hence a call upon science to aid, and science in turn called upon the practical man for assistance, and hence, as is usually the result of an earnest call, the man appeared in the form of numerous practical men with a fair education and a leaning towards scientific methods; and united effort has done much to investigate into causes, to explain and suggest, and has succeeded in elevating the character of our dairy manufacture, and making happy the homes of our dairy owners.

In this manner, and of this genesis, was the philosophy of dairying, and its course must be traced through a study of individual contributions of what has been done in the way of reasoning from causes, and of the efficiency of their conclusions.

As we are treating of American dairying, we shall use for our purpose the reports of the American Dairymens' Association, and shall confine ourselves to these volumes, ignoring the work which has appeared elsewhere in strictly scientific publications, or in general dairy treatises. As we necessarily shall have to deal with the writings of gentlemen still living, and many of whom are within sound of our voice, we must apologize in advance for our boldness, and claim the justification of an honest endeavor to realize the judgment of posterity, for this centennial purpose. If we overlook or misjudge any one, it is unintentional, for our personal relations with our dairymen are of the friendliest character, and we desire to do full justice.

Philosophy is the knowledge of phenomena as explained by causes and reasons. The philosophy of dairying is therefore the reasoning applied

towards the explanation of facts observed in practice or assumed to exist, and this explanation may originate from the effect or from the cause.

The first appearance of philosophy applied to dairying, that we note in our reports, is from the pen of Anson Bartlett, of Ohio, in the first annual report of the American Dairymens' Association, 1865, page 83. He there endeavors to explain the occurrence of taint in milk from the formation of gaseous products through the decomposition of the albumen of the milk, and to support his hypothesis (we use his word,) he reasons from the chemical analyses, and his own observations upon the treatment of milk which had become tainted. We have here a true philosophy, because causes are sought, and an endeavor is made to connect these with the effects. In the fourth report, 1868, page 38, L. B. Arnold, of New York, accepts the fact of there being gas in the milk which may result in taint, and reasoning from the physical nature of gases, he suggests the cause of its action. He calls this gas "odor" and says, "milk with the odor out has, in my experience, invariably soured instead of tainting." He proceeds with his reasoning and statement of experiment, and theorizes that, in connection with the rennet, this "odor" or gas becomes a ferment, which evolves new gases, which, acted upon by the temperature, swell and bulge out the cheese, &c., &c. His conclusion is that "it is the infectious gas or odor that does the destructive work in new milk, and it must be got out to be avoided." Dr. Westcott, of New York, holds, on the contrary, that "putrefactive fermentation commences the very instant the milk leaves the cow, &c., and adduces the milk globules, with their "specific levity," in his argument, and finally reasons that the milk must be cooled to "kill" the changes which occur in the milk, and the "*cooling medium must be applied to the upper surface* of the milk to be cooled." (The italics are his.) Mr. B. B. Moon, of New York, page 65, attributes floating curds, through a process of reasoning and from observation, to the introduction of putrid germs, and is finally led to the belief that the *cause* is that putrid fermentation takes the lead over lactic fermentation, "producing offensive gases that expand the particles of curd, thus decreasing their specific gravity." Mr. G. W. Davis, of New York, on page 67, ascribes the taint to the furnishing of stagnant and impure water to the cows, but this is offerred more as a statement than as a process of reasoning.

In the fifth annual report, 1869, page 17, we find an admirable address by Professor George C. Caldwell, of Cornell University, upon "Fermentation and Putrefaction in their relations to the manufacture of cheese." He develops the fact that every case of fermentation or putrefaction is attended with the development or growth of living organisms, and that "*these organisms are the cause of fermentation and putrefaction,*" and that these germs of putrefying matter are contained in the dust of the atmosphere, &c., and that the results of their presence on the fluid depend more upon the chemical composition of the substance that is decomposed than upon the species of fungus producing the decomposition. In the course of his remarks he brings out the fact that the separation of the butter is purely physical, while the other changes in the milk are much less simple, being largely chemical; on account, therefore, of its chemical nature, milk fresh from the cow requires special treatment to preserve it in its palatable form for a reasonable length of time. He

shows the changes of milk called souring to depend upon the conversion of sugar of milk into lactic acid. He shows that this is a true case of fermentation, and is accompanied by the presence of organisms. He advances that these organisms, called micro-coccus, are presumably always present in milk. He shows the temperature at which these micro-cocci best develop or grow, and hence reasons that the bringing of the milk to a low temperature will retard their development, and thus assist in preserving the milk. He then speaks of the curdling of milk, and the action of rennet, and connects this action with the presence of a ferment. He ascribes taint to similar causes, and explains the ripening process which cheese undergoes to a like cause.

In this address we have the first appearance of a philosophy applied to milk as a whole, and it is strong evidence of the value of a trained scientific mind to men engaged in practical pursuits.

In the same volume, page 126, appears a valuable paper by L. B. Arnold, on "Rennet, its nature and use," where by a series of philosophical reasoning from experiments, the fact is developed that rennet acts through cells which it supplies to the milk, and is thus of the nature of a ferment., Thus imperceptibly has the question of taint, with which we commenced passed into the broader one of ferment.

In the third report, 1867, page 70, Professor Brewer, of Yale College, brought to the attention of dairymen that ferment produced changes in milk, and the reasons for the scalding of pans.

In the second report, 1866, page 116, Mr. Anson Bartlett refers the changes which so readily takes place in milk to its very complex chemical nature, and to the high, combining numbers of many of its constituents, and hence the danger in exposing milk to putrefactive odors, &c. In the first report, 1865, pages 126 and 129, he ascribes bad flavor and porousness of cheese to the milk, evidently having in mind taint and its concomitants, and to that hurry which prevents the proper treatment indicated by experience.

In the seventh report, 1871, page 99, we have given an account of the passage of fungi spores through the blood of the animal and of their appearance in the milk, through a course of reasoning based on experiment by Professor James Law, of Cornell University.

The conclusion from these observations must be that, in ferments, and their methods of access and their character and history, we have an efficient cause for the effects known as souring of milk, taint, floating curds, &c. This is the result of the philosophy which has engaged many laborers, but which the gentlemen above named have been active agents in bringing before a dairy public, and to whom we have endeavored to give the proper credit.

The first reasoning that we find before the dairymen concerning the milk globule is by L. B. Arnold, and is to be found in the third report, 1870, page 80. Herein was an attempt to account for a practice through a theory. In the seventh report, 1871, page 96, we find more reasoning by this gentleman, wherein the milk globule takes part. We have probably overlooked his use of the milk globule in theorizing concerning butter-making, for we have frequently heard him discuss the subject from the globule point of view. In his late valuable work entitled American Dairying, the fruit of his riper experience, we note an apparent abandon-

ment of his earlier ideas, the result of greater maturity in his methods of thought, and a more thorough training.

In the ninth report, 1873, page 132, occurs the most fundamental philosophy concerning milk that we have seen. You will pardon the author for referring to his own work in this connection, but his plan leaves him no choice. Dr. E. Lewis Sturtevant, of Massachusetts, studies the globule from the cow. He attempts to show how these globules are related to the breed; their connection with the quality of the milk, and with the character of the butter. He has endeavored to apply to his dairy studies the methods of modern science, and the article referred to here is but the commencement of a series of demonstrations which have appeared elsewhere.

In the tenth report, 1874, page 39, the same writer explains the action of cream from the physical reactions of the milk globule, and the relations of churning to the structural element. He philosophizes on the causes underlying the question of deep and shallow setting of milk.

In the eleventh report, 1875, page 42, occurs an article by Eastburn Reeder, of Pennsylvania, on "Dairy Farming," wherein he philosophizes on the relations of temperature to cream, and the effects of the expansion thereby resulting.

In the tenth report, 1874, page 51, F. O. Stone, of Ohio, treats of butter, and reasons from experiment upon the absorption of odors, on the treatment of milk for the purpose of the butter maker.

In the eleventh report, 1875, page 49, L. S. Hardin, of Kentucky, furnishes an article on butter making, and in an entirely practical way, intended to advertise his "system," claims that the cooling of milk and the keeping of it cool, is of great advantage in butter making. He also advocates deep setting, and claims that the tight covering of the pails prevents the escape of the aroma from the milk and preserves it for the butter. This article is more a statement of claimed facts than a philosophical one, yet it comes so near the line marked out as a limitation to our essay, that we have concluded to mention it.

In the tenth report, 1874, page 75, Professor Caldwell has an essay on the "Condition of Fats in Butter and Cheese," philosophical in tone, and of great interest. He treats of fats, and the reasons for their rancidity, and their probable method of formation.

In the eleventh report, 1875, page 104, this same writer treats of the "Preservation of milk," and shows by reasoning some of the causes of decomposition, and how they may be obviated.

We have now completed our survey of contributions to the philosophy of dairying as they appear in the reports of the American Dairymen's Association. We feel conscious that we have overlooked some contributors, as from the difficulty oftentimes of deciding between statement and philosophy, we have had feelings of doubt. We think, however, that we have substantially brought together the class of contributions that we have sought, and while on reflection, we feel gratified that there are so many, yet we must confess to a feeling of surprise that they are so few.

Let us call attention again to our subject—the Philosophy of Dairying (American—as affecting our dairy practice.) Were we treating of the Literature or the History of Dairying we would not have omitted mention of one whose influence has been paramount over the success and ex-

tension of the American Associated System. There are others besides Mr. Willard, whose names, although not mentioned here as not being included within our scheme, are yet deserving of honorable notice.

Upon a careful review of the names we have presented, we would single out Professor Caldwell, Mr. L. B. Arnold and Anson Bartlett, as the three writers whose efforts have been marked for originality of presentation, and as men of a philosophical tone of mind. Their ideas are not always new, nor are all of them original, and it would be underrating their intelligence for us to allow for them such a claim. Their addresses were, however, new to their audiences, many of their opinions original with their authors, and all of benefit in influencing thought and action. Their labors have been of exceeding use, and to these, as well as to many other dairy writers, must be given the high praise of having successfully established an American Agricultural Literature.

PHILOSOPHY OF DAIRYING—THOUGHTS FROM THE AUTHOR'S STANDPOINT.

The subject of dairying must be studied from the cow, as milk is an animal substance, formed by and for the cow. Its quality as well as its quantity is largely governed by the individual, and by the breed from which it is procured. The cow gives to it of its structure, as well as serves as the medium through which its chemical elements are derived. Hence milk has its typal relations. (1)

Probably no one would have the hardiness to claim that the milk of the ewe and the goat, of the mare and of the cow, are identical, and yet such a claim would be as reasonable as the affirmation that the milk of all the cows is identically the same. Indeed, reason and experience combine to show that milk in its various samples may be of different specific gravity, may contain different percentages of cream, butter, sugar, albuminoids and ash ; that it varies with the individual, with the breed, with the time of calving, with the feed, and with various other circumstances.

There is a reason for all this, if we but have the patience to seek it. This reason is in the cow and her structure. We may study either from the cow to the milk, *a priori*, or from the milk to the cow, *a posteriori*, and this latter way seems preferable for our purpose.

MILK.

Milk is a complex fluid ; it has structural and chemical affinities, and partakes in its reactions after withdrawal from the udder, of these qualities which its constitution and history has impressed upon it. Its structural element is a morphological one ; that is, it has a form. This form-element is mechanically mixed with the milk, and is subject, in its relations to the rest of the milk, to the physical laws attending a mechanical mixture. Its chemical elements are compounds formed from elements in a high combining number, and which are readily changed from slight causes which tend to disturb their equilibrium. One, the sugar of milk,

(1) See Milk ; its Typal Relations, 5th Rept. Vt. Dairymen's Ass., 1873-4, 27 ; 9th Rept. Am. Dairymen's Ass., 1874, 132 ; also Remarks on Milk, Ag. Mass., 1873-4, 93 ; Milk : some consideration concerning its morphology, ib. 1873-4, 374. Also an unpublished prize essay of the New York Agricultural Society of 1873, on "Milk," with illustrations from nature of the structure of milk glands. Also Appendix to "The Dairy Cow, Ayrshire." Milk : its Formation and Peculiarities.

is a crystalloid, while the nitrogenous materials are colloids; this is to say, that these two classes of bodies are acted on differently by animal membranes. The bulk of milk is composed of water, a substance rather inert in its chemical relations, transudative in its relation to membranes, and influential as a media for the proper distribution and dilution of the more sought for elements.

THE GLOBULE.

The form element of the milk is the globule. This is an animal cell, enclosing the fats of the milk, and is formed within the recesses of the ultimate follicles of the milk gland by a proliferation and separation of the cells which form their living. They hence are dependent for their size, and for their number, on the size and activity and number of these cells, and the number of the cells is determined largely by the number of follicles contained in the gland. The milk globules, in a word, are at one time of their history, animal cells, attached to the interior surfaces of the follicular structures of the udder glands, and partaking of the structure, and influenced in character by the cow. These cells are indeed animal growths; they receive their contents through the vital processes of the cow, and the material of their contents comes from the blood supplied by the innumerable capillaries which form a net work about the glands; and the blood in turn receives its supplies through the medium of the stomach. Thus the forces of the herbage are passed through the agency of the cow into the cell which is through a process of changes to become a fat cell, a milk globule, and a component of that butter which renders our bread so palatable.

What relations then do we expect between the milk globules and the cow? Why, even this, that being a cell, structurally, of the cow, its covering will be an animal membrane, and must vary in many respects with the animal of which it was a part. A succulent food, which excites all action into rapid and juicy growth, will increase the formation of milk globules, and furnish a large percentage of butter in the milk. (2) Food which exerts distinct action on the cells of the body, and which has a particular tendency to affect the cell action of the gland cells throughout the skin, as does linseed meal, seems to exert a like influence which is recognized in the milk. The cells of the glands swell larger before being detached, and the milk globules are consequently larger. (3) As we know there is a difference in the meat of cows, that is a variation

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(2) For the purpose of illustration we offer some original analyses made for this purpose by S. P. Sharpless, of Boston, the cows being No. 1 Ayrshire, No. 2 Jersey.

	Pasture and fodder corn.		Pasture and corn meal.	
	I.	II.	I.	II.
Specific gravity, - - -	1030	1030	1030	1033
Cream - - - - -	.20	.22	.5	.18
Sugar - - - - -	5.20	5.67	3.94	4.19
Casein, etc., - - - -	3.34	2.64	4.82	5.17
Ash, - - - - -	.60	.62	.65	.72
Fat, - - - - -	4.34	5.07	2.48	4.35

These analyses were pure milk of the same cows in either series, and were of the evening's milk of Aug. 20 and 27, 1876, the cows having been kept on the food noted for some time previous to the day when the milk was taken.

(3) See my experiment given in Note in Rept. Conn. Board of Ag., 1874, p. 50, also p. 49.

between their muscle-cells, so should we expect to find variation between the milk cells of different cows, both in respect to size and structure. In fact, the enveloping membrane of the milk globule in the Jersey breed of cow is weaker, or more readily broken than the corresponding globule of the Ayrshire cow. (4)

By the action of food, during the milking season of a cow, it is unreasonable to suppose we can increase the secreting surface of the udder, but we can increase the rapidity of action, the vitality, so to speak, of the gland action or growth, and through this increased rapidity, and the changes of size of the cells thrown off produce change in the product both as to quality and quantity, until the limit of capacity is reached. The amount of change must be governed largely by the nature of the cow, and somewhat by the character of the food and feeding. A starved cow would be expected to furnish small globules to her milk, a well fed one globules harmonious with the type of her breed. A special food would be expected at times to mask the typal relations, and exceptionally to carry the size above or below what we should expect. Again, just as we expect the meat of the well fed and skilfully fattened cow to be tenderer, sweeter, and in every respect better than ordinary, so should we expect the corresponding changes in the character of the globules furnished to the milk. No amount of good feeding is expected to fatten a sleazy, ragged cow of the road, into the equal of a high bred, carefully attended short-horn, because they are structurally different. For this same reason, we cannot expect through abundant food to change the structural element of the milk of the inferior cow, so that it shall equal the same element of the cow of approved excellence. Hence, *breeding for milk* is no misnomer. The expression is philosophical, reasonable, and in accordance with experience.

Again, the udder is a special gland for a special function. It is under a certain nervous influence and control, through which it correlates with the womb. It commences preparatory gland action towards the termination of pregnancy, and with the appearance of the calf is in full activity. The vessels of supply are active, the cavities of the udder are distended, and perhaps engorged, through the active cell, creation. The products are pressed upon by the new supply, and the pressure is given back through the resistance of the elastic tissues. As time goes on, and the milk is removed, the processes change their activity, there is less of rampant energy, until finally all this especial action ceases, snd the glands relapse into a state of quiet. We recognize the result under the names of colostrom, milk, and drying off. During this time, various elements of disturbance may occur. Nervous influences arising from gestation, or from causes external to the cow, react upon the udder action, and there is a constant loss of and seeking for equilibrium in the gland action. Hence a variation in the size of the milk globules and in their number, from milking to milking, and a change which is determinate, and which is coincident with distance from calving, and the presence of the foetal life. So we pass from the disturbed and overactive condition measured by the colostrum, wherein the globules appear attached to each other and to the basement membranes as if violently

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(4) See my experiment in Ag. of Mass. 1873-4, 383.

torn off, and show aggregation into clusters, and segregation from the parent cell scarcely complete, to the normal milk with large globule, varying daily in size, but on the average decreasing in diameter with the lessening activity of the gland action, until finally quite an uniformity of size, and quite a comparative minuteness preceding the cessation of the milk flow.

CREAM.

We have, in our milk, globules of different sizes and covered by a membrane of varying toughness. On account of this peculiarity, when our milk is at rest, "setting" as the term is, the larger globules, on account of their superior buoyancy rise to the surface first, while the smaller globules may be so slow of movement as to become entangled in the thickness of the milk, through the changes consequent on time. Hence, the average size of the globules are greater on the upper than on the under surface of the cream. Because of this arrangement, the globules in equal numbers do not occupy equal space, but a cream of a million globules more or less might occupy a greater or less space than another cream of the same number of globules, but of different size. As, however, there is a great variation in size between the different globules in a given milk, and in the relative number of the different sizes, one cream may contain a greater or less number of globules in a given space, and even a greater or less quantity of butter. We even have other circumstances affecting the space to be occupied by a given number of globules: this is the condition of the other elements of the milk. Oftentimes cream rises entangled with considerable quantities of albuminous element, and its apparent bulk is very largely increased; often, indeed, from unknown causes, the same milk will show marked difference in its cream percentage, in difference glasses and under slightly different conditions of setting. (5) In brief, changed conditions of the milk as a whole will affect the action of the milk globule in rising and compacting.

If we take a measure of BB shot which will weigh just 4 ounces, and another measure of No. 10 shot of equal weight, we will find them occupying equal bulks. We can, however, pour a considerable quantity of the No. 10 into the vessel containing the BB shot, without increasing the bulk, for the fine shot will occupy the interstices of the larger. In like manner, a cream containing a large number of large and small globules mixed will contain more butter than the same measure of cream of an uniform size of globule, and large ones at that. This is to say, that as milk always contains globules of various sizes, and of various relative proportions of sizes, we should not expect any definite proportion to exist between the percentage of cream and the percentage of butter. (6)

CHURNING.

When our cream reaches the churn, we should also expect to find differences of reaction dependent on the size and structure of the globules.

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(5) We have in mind one case where the same milk which read off 11 per cent. of cream at home, read off 25 per cent. after being transported a few miles the next morning, and then set; in another instance the reading changed from 13 to 29 per cent., and in still another case from 10½ to 5 per cent.

(6) Aug. 13, 1876, I took the milk from each teat of an Ayrshire cow and this milk kept over night, and then taken to Boston was analyzed by S. P. Sharpless.

The larger globules should churn first, and also, in a competitive trial, the weaker membraned-globuled cream should churn quicker than another cream wherein the globules have a covering of a tougher character. (7) We should also expect some of the membranes to be weakened quicker, by the chemical changes progressing in their vicinity, in one case than in another. We should expect this action to occur differently, in respect to time, in the milk globules furnished by different breeds of cows.

As the larger milk globules churn more readily than the smaller, under given conditions, that milk which contains the most uniform set of globules would be expected to churn the most butter in ordinary practice, from a given percentage of fat. When the butter *appears* to have come, the churning is usually stopped, so as to avoid the evil result of overchurning; yet some butter, from the smaller globules, can often, if not usually, be obtained by a prolonged churning of the buttermilk. So also as the larger the globule the quicker and more easy the churning, do we often find our best butters produced from a large globuled milk; butters which have a grain, as it is termed. A small globuled milk should be expected to furnish a butter of less grain; and one in which the globules are very minute: butter which is nearly salvy.

As the character of the butter depends in part upon the size of the globule, and apparently upon the non-disturbance of the natural arrangement of the butter-fats within the membrane of the globule, we should anticipate an injury from an overchurning, as an artificial arrangement of these fats cannot be expected, by the process gone through, to equal the natural arrangement. Moreover, from the difference of character presented by different globuled milk, we should expect different results from the churning of cream of different risings. This is to say, the butter from the first skimming of a pan of milk would be of different quality from that made from a later skimming. (8)

In the continuation of this line of thought may be sought explanations concerning the deep or shallow setting for cream, as well as the effect of temperature upon the risings. Butter making is largely dependent on the structural qualities of the milk, perhaps nearly entirely dependent, consequently the study of butter making, and the explanation

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No. 1 was the milk of the right forward teat, No. 2 of the left forward teat, No. 3 of the right rear teat, and No. 4 of the left rear teat.

	I.	II.	III.	IV.
Yield, in pounds	2.09	1.25	1 05	1.25
Specific gravity	1025	1024	1026	1028
Cream	25	42	29	24
Sugar	4.09	1.18	3 44	4.20
Casein and Albumen	4.48	6.58	5.00	5.50
Ash	.69	.61	.66	.67
Solids not fat	9.25	9.37	9.10	10.46
Fat	5.59	4.43	4.39	3.84
Total solids	14.48	13.80	13.49	14.30
Per centage of butter to cream	22	10	15	16

(7) In this connection see experiments of mine in Ag. of Mass., 1873-4, pp 378, 379, wherein the time of churning is shown to be co-related with the globule. See also ib., p 383.

(8) See Rept. Conn. Board of Ag. 1874. pp. 94, 95.

of the changes which so frequently recur in the results of the churning, may be sought through the study of the milk, going back even to the cow.

SUGAR OF MILK.

In sugar of milk we have a crystalloid principle which appears in the milk, but which does not occur, so far as we can determine, in any other fluid of the body. We know but little as to how the sugar of milk is formed, or as to how it passes into the milk. We may probably assume that it is separated from the blood by the character of the membranes through which it passes, and that its appearance would be coincident with the presence of starchy or saccharine matter in the food. We have reason to believe that the feeding of fodder corn, a food abounding in saccharine matter, is followed by an increase of sugar in the milk, and that the character of the gland determines also the presence of the sugar in a greater abundance. This is also as we should expect, because the quantity of cellular tissue and membrane, both absolutely and proportionately must vary with the gland. (9)

If sugar is the result of a dialytic action on the part of the membranes we should expect the amount of sugar of milk, in the milk, to vary with the food of the cow, and also to hold great constancy under like conditions of feeding. Indeed, as milk is ordinarily taken for analysis from the whole udder of cows under normal conditions, we would be greatly surprised to find striking differences in the results of different analysis, and yet we are prepared to look exceptionally for great variations. (10) Especially should we expect variation caused by the decrease of tissue activity, and as influenced by the different quantity of milk yielded to the supply by the different glands.

CASEIN.

Casein, or curd, or cheese, is one of the nitrogenized compounds, and belongs to the class chemically called colloids. As it occurs in the milk, it is transparent, the whiteness of milk depending on the milk globules alone. It is probably present in the milk through the action of the membranes, although this view at present has not been experimentally proven or shown to be possible. It is, perhaps, a changed form of albumen. Indeed, its ultimate analysis differs less from that of albumen than the analyses of the same substances often differ in the manipulation of different chemists; yet albumen and casein occur in milk in juxtaposition, and while the sum of these two elements may remain quite constant, their relative proportions may vary. According to Gmelin, when, milk is diluted with water, and allowed to sour, it contains no casein, but only albumen in solution. In the presence of casein, as in normal milk, the albumen is not precipitated by boiling, nor does it usually coagulate with the casein in the presence of rennet, although in

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(9) In an analysis of milk from each teat of an Ayrshire cow, as given in note 6, we have for our determinations of sugar 4.09, 2.18, 3.44 and 4.20 per cent. respectively.

(10) Simon found that neither an abundant nor an insufficient diet influences its quality. See Lehman's Phys. Chem. i. 264. See also analysis of milk of fasting and well fed women, in Milk Journal of Aug. 1, 1872. See also comparison between the milk of the African and Caucasian race, in Am. Chemist, April, 1876.

the whey, when at a boiling temperature, it is readily precipitated by the same re-agents, and also takes on different appearances when precipitated and dried. It seems to have a character of its own for each species of milk, and also for each variety. Human casein shows differently and acts differently from cow casein; the casein of an Ayrshire's milk from that of a Jersey's milk, etc.; yet the differences are often but slight.

This substance occurs elsewhere than in the milk, notably in the interstices of the muscles, and may appear in the product of various glands. It has been found in the juice of flesh. This would indicate that its appearance is due to a dialytic action of animal tissue, and that its quantity would be determined somewhat by the laws governing the transmission of compounds through membranes at varying pressures.

If this idea is a correct one, we should look to the glands themselves, to the quantity and activity of their membrane surface, and to the pressure exerted by the blood and through muscular contractions, for an explanation of such variations as we may note in the quantity of the casein in the milk; and if we assume that casein receives its properties from and by this transmissal through the membrane, (an entirely gratuitous assumption,) we would infer that an insufficient diet for the cow would react upon the milk by increasing the proportion of albumen, at the expense of the casein.

From these premises we could argue that the nitrogenized constituents of milk would be little influenced by change of food provided the food was in sufficient quantity and of good quality. That the quantity would be determined by the extent of gland surface,and that, accordingly, each gland of the udder would furnish its own quota to the milk. Hence variations in the quantity in the whole milk would occur from the varying quantity of milk furnished from each gland; yet let us remind our hearers that our premises are rather uncertain, and hence our conclusions may be somewhat questionable. (11) Yet we will continue. We would infer that in some cases we should find striking variations in the amount of casein in the milk, according to various circumstances affecting them in their environment; yet some cows would be found in which this substance would appear in remarkable constancy. We would infer that any stimulus to gland activity would react slightly on the casein element, and as such gland activity is in a degree structural, we should expect to find the action more marked in one cow than in another. (12) In a word, we should expect variation in individual milk analyses, constancy in milk taken as the average of a herd; very little influence, on the average, from change of food or from season; yet variation consequent upon increase or decrease of tissue activity and influenced by pressure of the fluids both from within, outwards, and *vice versa*. (13)

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(11) In the analysis of the milk from each teat of an Ayrshire cow, see note 6, the per centages of nitrogenized compounds were found to be 4.48; 6.58; 5.00; 5.59; the apparent average being 5.41 p. c., while the real average was 5.28 per cent.

(12) In a series of analyses of milk from two cows on similar feed, the variation in casein, as determined by S. P. Sharpless was as below:

Jersey cow,... .. 1st period, 4.42; 2d do., 2.64; 3d do., 5.17.
Ayrshire cow,.... 1st period, 3.34; 2d do., 4.13; 3d do., 4.82.

It will be understood that each period was on a changed food.

(13) See Rept. Conn. Board of Ag., 1874, p. 62.

The weak point of *our* reasoning regarding casein, however, is in our premises, which are largely based on reading—quite little on our own investigations, and which, at the best, are largely suppositive. We are not aware that sufficient knowledge concerning this substance has been recorded, or that investigations regarding the method of its formation have been made. Our conclusions must, therefore, be considered largely tentative and subject to future revision.

ASH IN MILK.

The ash element of the milk may be assumed to appear from the membrane enclosing the globules, and from the albuminoid combinations. This assumption is as good as any other that we can offer until the matter is better understood, for there is some reason for this belief. We but mention the matter to call attention to how little we know about it. We are aware that the presence of a membrane which is to furnish an ash, is denied by some, but our reason tells us that it must exist, and our observation has told us that it does. A series of studies on milk will not be complete until this matter of ash, whence it is derived, and how it appears, is investigated.

WATER IN MILK.

Water is the most abundant portion of milk, usually comprising about 85 or 86 per cent. of its weight. It has its uses in the udder, reasoning from the structure of this organ, and from the action of membraneous tissues, in aiding the passage of the other elements of milk through the membranes, in lubricating the inner glands, and in removing the material from the secreting glands into and through the ducts into the reservoirs. It acts thus to obviate the risk of impaction of the globules. It is probably transudative in the method of appearance, and is probably absorbed by the tissues from the udder into the circulation, as well as issuing from the membranes of the capillaries, etc., as such is the law of osmose relating to fluids of different densities, different chemical structure and under varying pressure.

We will now proceed to philosophise concerning milk as a whole, passing by the attractive field of correlative gland activities, and the influence of localized action of one part of an animal on another, as well as the subject of correlative structure as influencing the quality of milk.(14) It will be necessary to repeat ourselves somewhat, but by so doing we shall give a stronger unity to our scheme.

MILK.

From what we have already said, it will be realized that milk is a complex fluid, with chemical and mechanical affinities varying in quality from milking to milking, according to the breed of cow, feed, time of milking, etc., etc.,; that when considered in bulks, that is, as the product of numerous cows, it shows quite a stable composition, and varies more with the season from calving, than from sample to sample.

When milk is allowed to remain at rest, we have first made evident the structural element, in the rising of the cream, and the thickness of this deposit is dependent not so much upon the amount of butter in the

(14) For a slight discussion of this subject see chapter on "The Ideal Ayrshire" in the "The Dairy Cow—Ayrshire."

milk as on the arrangement of the globules, and on the condition of the medium in and upon which they float. As the cream stands, it compacts more or less, according to its condition physically and relatively. The globules become weakended as to their membranes. In the course of time an acid condition of the milk supervenes, and the caseous element of the milk separates in a white mass, known as curd. At a later date the sugar of milk becomes decomposed, and in time an alcoholic or putrefactive fermentation takes place, and an extremely offensive odor is evolved. The surface of the cream meanwhile, as offering lodgment for the atmospheric dust and fungi sporules, takes on a fungous growth, the blue mould. Ultimately all the milk disappears in the course of decomposition, as but a little ash is left, a mineral matter which cannot escape into the air on account of its nature.

During the process of milking, some of the globules are liable to have their membrane broken and the membrane is constantly weakening, on account of the influences brought to bear on it from the medium in which they float. Hence, free oil is often to be detected both in new and old milk, and it is in reason to suppose that conditions could be so framed by which this process of membrane disappearance could go on apart from the action of churning, and butter could be produced. Under the ordinary process, however, through the mechanical agency of the churn, these globules are broken, and their contents aggregated into mass, and thus the butter of commerce is produced. That churn which best effects this action is the preferable one, but as these globules are not of one size in all milks, and as the membrane is not of equal strength in all milks, the difficulty of deciding upon the best churn is great. The large globules always break first, presumably from offering greater resistance to the currents carried by the dasher, or by its blow, and also presumably because the larger globules have a more tender covering. At any rate, the smaller globules churn later, and many are so minute as to remain behind in the buttermilk. The fats of the globules are of different kinds, and, we may presume, have a certain arrangement and proportion of their own. When we interfere with this arrangement, through overspeed of our implement, or through overchurning, we must anticipate a deterioration in the quality of the butter, because of the disturbance of this arrangement, and the substitution of a different and less perfect one. These things being so, it is obvious that a different problem is presented to the manufacture, whether he churns milk or cream, or fresh or rather old cream, also whether he uses milk of one character or another.

Should milk be skimmed while sweet or after it has soured? If we reason upon this, according to the facts presented *passim*, we should say that the answer depends on the character of the milk; that while one milk will give satisfactory results when skimmed sweet, or just as it commences to lobber, another milk would require to remain considerably longer, so that the tougher membranes of its globules should be weakened equal to those of the fresh.

Should we advocate deep or shallow setting of milk? The reply comes to hand that either way may be the better, according to circumstances. Let us consider the matter at the ordinary dairy temperatures, and we would expect a deeper proportional thickness of cream on the deep set milk, for as we increase the depth through which the globules are to rise,

we offer greater opportunity for them to become of assorted sizes. Yet as the globules are scattered all through the milk at the time of setting, we cannot expect absolute regularity of arrangement, nor in all cases very marked proportional increase in cream percentage unless we know our milk. When skimmed at the same time, and churned, we should expect a greater weight of butter taken from the shallow pans, while the quality of the butter made from the cream taken from the deep cans should be slightly better. Yet practical experiment might give apparently a different, or at the least contradictory results, as the water percentage in the butter made by the different processes might vary sufficiently to carry the quantity from one side to the other. This question deserves a practical study, through the process of the churn and through chemical analysis. Pure reasoning based on such premises as we have, would lead to a recommendation of deep cans for the use of fancy market butters, which reach the customer soon after being made, and shallow pans for those who pack their butter and market in bulk at a date distant from the making. The question to be decided, however, is which makes the most butter, not which pound of butter contains the most fat; which butter will keep the better under the conditions asked for by the maker, not which will keep the longer. If 13 or 14 ounces of butter will sell for a pound and bring the price of the best pound, this is certainly an important fact for the dairy farmer to know how our best butters, even when apparently dry, contain considerable water, even at times as much as 20 per cent. or more. From certain English analysis it would seem as if the better the butter the more the water; the more the water naturally entangled with the fat, the better suited the buyer, and the more profit to the maker. Reason would suggest that butter rightly made from a large globuled milk would contain more water, under the circumstances, than a butter made from a small globuled milk. A farmer cannot always afford to get too much butter from his milk, for it is usually at the expense of quality; so likewise, paradoxical as it may seem, by obtaining the most fat from his churning, he may be obtaining the less butter,

Milk is a complex fluid; do not let us forget this. Hence, at what temperature we should keep our milk for the purposes of the butter maker is a difficult question to answer. As an animal product, milk is exceedingly subject to decomposition, and readily offers a nidus for the growth and developement of fungi sporules always present in the atmosphere, and usually in its own mass. These spores do not develop as rapidly at a low as at a high temperature; hence, when the milk is kept at a temperature which least allows of the growth of these spores, the longer it remains sweet, and the longer opportunity for the rising of the cream.—The expansive and contractive action arising from changing temperature, however, present a different ratio for the structural, as distinguished from the fluid elements of the milk. It is probable that the increase in density of the fluid portion, through the lowering of temperature, allows a quicker rising of the cream, for its globules are not affected proportionately with the rest on account of their form being spheroids. We may also consider the effect of the temperature at which the milk is kept upon the condition of the fat enclosed in their cells. It is probable that milk set at 40° and 100° or even 120° would make different quality of butters; in what these differences would consist we can hardly predict

in the present state of our knowledge, yet, should we venture a half-opinion, it would be that the cooler milk would furnish a cream that would churn a butter of a more decided grain. Then we would expect that these butters made from milk set at different temperatures would possess different keeping qualities. The harder fat of the cooler cream would naturally be supposed to present a different surface for the entanglement of water than would the fat softened by heat. As it is found that butter deprived of its water of union by being melted and then tightly corked, is not subject to ready decomposition, but will endure unchanged the temperature of the tropics, we could reasonably infer that butter churned from milk kept at a warm temperature would preserve its character better than butter made from a milk kept cool. Yet such reasoning as this should be checked by experiment before being considered satisfactory.

On account of the similarity of casein and albumen in elementary composition, it would be reasonable to infer that, under the action of chemical changes in the fluid wherein they occur, that the one might increase at the expense of the other. Indeed Lehman remarks that "casein appears to us to be a highly transmutable substance, often undergoing change on the application of the mildest re-agent," and Gmelin asserts that casein disappears from watered and soured milk, and albumen takes its place. If these opinions of noted chemists be correct, we must expect that our milk, under process of manufacture into cheese, must contain at different times variable quantities of casein. Very likely many factories lose casein when a slight modification of their processes of making would retain it. The importance to the manufacturer of a thorough and scientific examination of the changes which may occur in milk should be realized and acted on by a class of men who have seldom in the past neglected to act for their own interest.

In treating of milk from the cheese making point of departure, we must again refer to the globule, as influencing the character of the cheese. It is but reasonable to infer that the larger globules, which have the lowest specific gravity, must be more difficult to retain *mixed* with the milk than the smaller globules. Hence more waste of the fat, in the ordinary working of the factory of one milk over another. As the globules, on an average, decrease in size as the season advances, (most of the cows calve in the spring months,) we should expect a smaller quantity of milk to be required for a pound of cheese in the autumn months than in midsummer or spring, and this cheese of a superior quality, As some herds of cows have smaller globuled milk than other herds, we would expect that, the percentage of casein and fat being the same, the small globuled milk would give larger amounts of cheese than the large globuled milk, and, under the ordinary process of manufacture, of a better quality.

And why of better quality? During the ripening of cheese, a portion of the casein or curd suffers decomposition, and is partially changed into ammonia; this ammonia, however, does not escape, but combines with the fatty acids produced in course of time from the butter. Such being the case, an even distribution of the fatty matter through the curd is desirable, in order that each particle of ammonia as set free, may at the moment, be in contact with the fatty acid which is supplied from the fat globule; now a small globuled milk must furnish more glob-

ules, and these more evenly distributed through the curd, than will a large globuled milk equally rich in fat.

Can skim-milk cheese ever be manufactured of a quality that will meet approbation? Reasoning from the fact that casein during putrefaction, which is at first ripening, develops at the first carbonate and hydrosulphate of ammonia, and, after a space of from two to five months, furnishes ammonia, valerianic acid, *butyric acid*, etc., we would infer that a cheese deficient in fats, if properly made and handled, might be ripened into a fair, even prime article. Indeed, by the application of an alkali, it is possible that the casein might become more quickly broken down, and the process of ripening intensified, regulated and made more complete. Here again we must refer to the seeming advantage to dairymen were proper experiments initiated and published for the benefit of whom it might concern. What changes could be produced in cheese making by a proper understanding of causes cannot be definitely stated, but can be conjectured as of vast importance to the dairy interest.

CONCLUSION.

We have now presented an abstract of *our* philosophy of dairying.—Whether the results claimed are correct or otherwise, must be determined by actual experiment. We cannot expect to treat of such a difficult subject as this without falling into some errors, and it is not usually the part of wisdom to predict results in advance, yet it has seemed to us that this occasion demanded some such treatment as we have given, and we can only hope that our errors will be brought to light through the research and study of others, and that we may receive the credit of initiating a renewed interest in dairy studies.

What the dairy interest imperatively needs, as it seems to us, is an experimental station, wherein a practical worker and a scientific worker can unite their forces and investigate the abstruse and the practical in common. The benefits of such an alliance properly carried out can scarcely be over-estimated. It is the peculiarity of modern advance that it seeks instruction from the past; that it utilizes experience. When we consider the advantage already derived by dairymen through associated effort, and how much assistance they have already gained through study and reason as encouraged and developed by this and kindred association, it needs not a prophet to predict that a still greater advantage would occur from a more systematic and more definite action continued under the auspices of our associations. Cannot the Dairymen's Association influence such work? Cannot it originate, even if on a small scale at first, an experimental station, wherein quick and practical results shall not be demanded, but simply the accumulation and testing of the facts of experience to be disseminated among those who are well fitted to apply these teachings to practice? When causes are understood, and the *reasons why* appear, we may hope for immense advance in practical manufacture, and practical milk supply. Why should not this Association have a professor of chemistry and a professor of dairying appointed, whose duties would be similar to those of the professor of botany and the professor of entomology of our horticultural associations? the chemist a true chemist; the dairyman not a manufacturer but the theoretical worker. This would be a beginning; the arrangement for work to be done at some of our colleges, and the assignment of material, space, and assistance by these institutions

would come in course, and rather speedily with a slight money assistance, and a full encouragement from our leading associations.

There was a good deal of interesting discussion following this and the subsequent address, while the Secretary was laboring under too much fatigue to record, and hence it has not been preserved.

The next paper was read by Prof. E. W. Stewart, of Erie Co., N. Y., on

THE COW AS A FOOD PRODUCER.

The great end and aim of agriculture is the production of human food; and the scientist of alimentation seeks to adapt that food to the highest development of the race. If a full history of the food used in the past by the human race were written, it would be a complete history of its different stages of development and progress. Indeed, a statement of the food used by the different peoples of the earth to-day, would be an index to their present civilization. Look at the peoples who subsist almost wholly upon vegetable and imperfectly nitrogenized foods. They are characterized by a want of enterprise and energy, seek isolation and non-intercourse—boast of an ancient civilization, which has made little progress in the last 3,000 years. They make little use of domestic animals as a means of producing food. The advancement of the race depends primarily upon its aliment. The muscles, nerves and brain power of man must be supported and vitalized by nitrogenous food, and the more progressed and highly organized this food is, the more perfect will be the muscular power, the more delicate the nervous sensations, and the keener and deeper the mental penetration.

We find, therefore, that those nations noted for enterprise, energy and scientific research are large consumers of animal food. Even the nitrogenous elements in vegetable food have not the potency and energy of the same elements when derived from the animal kingdom. When used as food, the gluten of wheat and the legumen of the bean and pea, have not the same force as the fibrine of meat or the casein of cheese, although isomeric and almost chemically identical. Every element that enters into and constitutes animal bodies is progressed and of higher potency than the same element obtained from the vegetable. This is the law of development.

The vegetable feeds upon the primitive elements of the soil, and prepares them for use by the animal; and the animal advances them to the highest potency for human food. The flesh, then, of our healthy domestic animals is the highest type of human food; and the milk of the cow, being formed from her blood, and containing all the elements of meat in an equal state of advancement, has the advantage of meat by being in a soluble condition, and therefore more easily digested. We thus find the milk of the cow to be the elixir of life. And when we consider this humble domestic animal as supplying a large proportion of human food, —her product swelling our commerce and returning a flow of gold half as large as all our mines—and considering its immense increase in the near future, we shall not greatly err if we crown her the queen of our agricultural temple.

Nearly all writers upon hygiene regard milk as the best standard of human food. And our theme requires us to examine the quality of this

food and the capacity of the cow for its production as compared with food of the same quality in the form of flesh meat.

We shall only have space for mere mention of many points. Milk chemically consists of :

Water,	87.20.
Butter,	3.95.
Casein and Albumen,	4.00.
Milk Sugar,	4.20.
Ash,	.65.
	100.00

This is about its average composition, and will be a fair basis upon which to judge its relative value. We see here that there is 12.80 per cent. of dry substance in milk, and that 4 per cent. is casein and albumen—muscle-forming matter. The milk sugar is an admirable supporter of respiration and animal heat, and the oil or butter performs the same office when required, but is primarily used to cushion the tissues with fat, round up and give plumpness to the body. That profound animal chemist, Liebig, speaking of the adaptation of milk as a food, says :—"The young animal receives in the casein the chief constituent of the mother's blood. To convert casein into blood no foreign substance is required ; and in the conversion of the mother's blood into casein, no elements of the constituents of blood have been separated. When chemically examined, casein is found to contain a much larger proportion of phosphate of lime or the elements of which bones are composed, than does blood, and in that very soluble form, capable of reaching every part of the body."

We find the elements of nutrition more evenly balanced in milk than in meat. Take ordinary beefsteak, and we find water 70 to 75 per cent.; albumen 18 per cent. and fat 7 per cent. ; the muscle forming elements are in too large proportion (nearly three to one) for a single food, and must be eaten with vegetables. In milk, the proportion of albuminoids is only one to three—making it a complete food in itself.

The most observing physicians find milk the most admirable food to restore an impaired vitality. In fevers when it is so difficult to keep up the vital forces on account of the danger of increasing the unnatural excitement of the system, milk is found the least irritating and the best adapted to assist nature through the struggle.

If we compare milk with the average composition of meat, (lean beef and fat beef, lean pork and fat pork, lean mutton and fat mutton,) we shall find meat to contain about 46 per cent. of dry substance, including ash ; and milk about 12½ per cent.

Thus, allowing no waste of food from bone and giving the odd fractions in favor of meat—4 lbs of milk will equal 1 lb of meat. And taking the avarege yield of a cow to be 4,000, the food value of the milk of a cow for one year is equal to 1,000 lbs of meat ; and this, we are sure, is not depreciating the comparative value of meat.

We have thus far spoken of milk in its complete form, but we must mention briefly the products derived from it.

The first and most familiar product is *butter*. This amounts to about 4 per cent. of the milk ; yet so popular is this product, that a great majority of the cows in this country are kept simply for its production.—

Butter, which contains only one element of the milk, when made by an expert, will produce a greater income than the whole milk made into cheese; and the refuse milk containing the most valuable element—casein and the milk sugar, or whey,—when properly utilized in feeding pigs or calves, will produce 200 lbs of pork or young beef for each average cow, per year.

And the remarkable point is here to be made, that the food in the refuse milk of a cow, after taking off the cream, will produce in a year as many pounds of meat, or calves, or pigs, as the average growth of a steer for one year.

The next important product of milk is *cheese.* This is now mostly made on the factory system, and is therefore of much more uniform quality and bears a price 50 per cent. higher than under the old dairy system.

Cheese is a most valuable article of food, and not sufficiently appreciated by Americans. The average composition of good cheese gives 72 per cent. of dry substance, all of it being nutritious, and as compared with good beef, is found to contain twice the nutriment in the same weight. It is now conceded that one pound of good cheese has the same nutritious value as two pounds of butcher's meat.

If then we compare the yield of food by a cow in the form of cheese, in a year, with the growth of flesh in a steer during the same time, we find that an average cow will produce 400 lbs of cheese, which has a food value equivalent to 800 lbs of dressed beef, and this 800 lbs of dressed beef requires three-and-a-half to four years to produce in the growth of a steer. Thus the food in the cheese product of a cow, in one year, is equivalent to the food in the beef product of a steer for four years, and this makes no account of the milk sugar or whey, which is more than one-third of the dry substance of the milk.

This is an extraordinary result, but we see that it is even less than a comparison of the food value of the whole milk with the growth in beef of a steer for the same time; for in that case, 4 lbs of milk was equal to 1 lb of beef, and it requires 10 lbs of milk to make 1 lb of cheese, but comparison gives credit for the milk sugar. We made the comparison of the cheese product of the cow with the beef product of the steer in a paper written by us some years since; but we mention it in this connection to call attention to a remarkable fact that the cow, during lactation, seems to have greatly increased digestive power and capacity for utilizing and assimilating its food, over that of the steer or herself when not in lactation. It has often been estimated that the food eaten by a steer during the four years (under ordinary feeding) required to produce a dressed carcass weighing 800 lbs, was about equal to the food required by an ordinary cow to produce 400 lbs of cheese per year.

This gives the cow a cheese product of 1,600 lbs in four years, equaling a beef product of 3,200 lbs produced upon the same food as is required by the steer to grow 800 lbs of beef. It must be borne in mind also, that the cow must supply the waste of her own system and keep up animal heat, besides producing 4,000 lbs of milk upon the food which she eats. And to show that this difference does not apply merely to the slow growing steer requiring four years to produce 800 lbs of beef, but applies as well to the most skilfully fed steer of the most approved breed, which can be made to reach 800 lbs of dressed beef in 24 to 30 months; because

when the latter is compared with the best cow, fed in the most skilful way, it is found that this cow produces 8,000 lbs of milk, and 800 lbs of cheese, instead of 4,000 lbs of milk and 400 lbs of cheese. There seems to be the same comparative difference in each case.

Now, it must be evident that, if the steer eats as much as the cow, he must very imperfectly digest and assimilate his food, or it requires twice as much food to make a pound of beef as a pound of cheese. We should also expect to find the manure of the cow comparatively poor with that of the steer. And the facts seem to prove both of these points; for it has been found, without explanation of the reason, that the manure of the steer is very much richer than that of the cow during lactation. Market gardeners have often mentioned this fact to us, as proved by their trials of the two kinds of droppings. We also, personally made an experiment to test it, and found a large per centage in favor of the manure from steers over that of milch cows. I regard this as a very interesting question to dairymen and well worthy of discussion before this Association. I have not been able to solve the reasons for the facts to my own satisfaction, but the facts nevertheless remain, and afford an interesting field for research, which I hope may be thoroughly investigated by the members. It shows also, how the dairyman may turn his farm crops to the best advantage; for if a given amount of food will produce twice the result when fed to a milch cow as when fed to a steer for beef, he can easily determine the most profitable road to travel.

Prof. Stewart's paper was followed by one from J. P. Sheldon, of Sheen, Ashbourne, Derbyshire, England, on the

RISE AND PROGRESS OF IMPROVED DAIRYING IN ENGLAND.

By many practical men it is disputed that there has been any improvement made in English cheese-making, and they declare that our cheese is now no better than it was a century ago. This latter statement is incapable of proof, but still it may be quite true if we look only at the average quality of the cheese now made and compare it with that made even so far back only as our own memory carries us. But no one can deny that great improvements have been made in the appliances of the dairy, and in general and scientific knowledge of the subject. In the olden times, say a century ago, very little cheese was made at all in England. The population was then small, and lived principally on bread and other kinds of simple food, whereas now they live to a great extent on stronger food, such as beef, and butter and cheese. The bulk of what are now our fine old pasture lands was given up to corn growing, and cheese was scarcely an article of commerce at all. The farmer in most cases made no more cheese than sufficed for the consumption of his own family and dependents. On a farm near to me, where about six tons of cheese are now annually made, no more used to be made, or at all events sold, in one year than was carried away on four "packsaddles,"—and this in the days of the present owner's grandfather. But for many years past large quantities of cheese have been made in England, and for an equal period it has been an important item in our insular commerce; there is, however, now less of it made than there was a few years ago, and this is

partly owing to so much excellent cheese coming to us from abroad, especially from America. Our dairymen now turn their attention more to feeding of cattle and sheep, to butter making, to the raising of stock,and to the milk trade.

My own memory serves me for a quarter of a century, at the commencement of which time the mode of making cheese was, except in a very few instances, most primitive and rude, and the utensils employed were perfectly innocent of any pretension to being the best and handiest possible; nor were they ever replaced by others so long as they could be made to answer at all satisfactorily the purposes for which they were made. At that time the milk was set for coagulation in the most haphazard manner imaginable; no thermometer was used, and a disparity of six or eight deg. Fah't was complacently deemed to be a matter of supreme indifference, and was treated with corresponding unconcern. The action of acidity was as little understood by cheesemakers as were the works of Tacitus or the orations of Demosthenes, and any approach to system or regularity in treating the milk, salting the curd, and curing the cheese, was constantly avoided as useless. After coagulation had advanced far enough, as was thought, the dairymaid would sit down by the cheese-tub, and with a wooden bowl or dish would break the curd gently or otherwise, according to her disposition, into irregularly sized lumps; these she would keep in motion until they had lost a good portion of their whey and began to sink more and more to the bottom of the tub. Then the whey would be ladled off and a piece of perforated tin or wood, fitting the tub moderetely well, would be lowered on the curd, and weighted so as to express more whey. Next a "ladder" would be placed across the top of the tub, and on the ladder a "vat," a cloth was spread over the vat, and the curd then placed in it in lumps. Then a flat piece of wood, not perforated, was placed on top of the curd; on this piece of wood weights or pressure would be put, and I have often seen the dairymaid herself mount on the board and by her own weight assist in pressing out the whey—and the heavier the maid the faster flowed the whey! Again, in some instances a long pole would be used instead of weights either living or dead; one end of the pole would be thrust into a hole in the wall and on the other sat a boy or the dairymaid—the vat containing the curd being about the middle between the boy and the wall, and the pole acted as a lever. This was an advance on the system of putting on weights, or the dairymaid getting on herself. Afterwards, two upright wooden screws were attached to the "ladder," and between them a piece of wood, which passed over the vat of curd; these screws were turned downwards at intervals by hand, and were undoubtedly a great improvement over the former plans. Last of all, the "lever press" was invented, and perfection was supposed to be attained; but this was followed by its adaptation to various apparatuses which were much discussed at the time, and were more or less valuable.

During the progress of these mechanical improvements in cheese-making, no advance was made in knowledge of the chemical laws which were unconsciously employed, nor were the properties of milk any better understood by the dairymen at large. Playfair and Voelcker had indeed recently demonstrated the chemistry of cheese-making and the laws which govern it, and they had done this in a manner which has since received

ample confirmation at the hands of other practical and scientific men, but their researches had never been appreciated except by a few of the more enlightened and progressive dairymen. Under the old system the curd was first manipulated in the manner described, and was then put under large stone-presses, in order to extract the remainder of the whey, and to press the curd into compact cheese. During the time it was passing through press a period of about four to six days, salt was daily applied to the outside of the cheese, none having been mixed with the curd previously. It was thus a matter of accident whether the cheese were under or over salted. They were also "dry-clothed" twice a day, the cloths absorbing the whey as it left the cheese.

The first decided improvement in cheese-making is mainly due to what is called the Cheddar method, with which the name of Joseph Harding, of Marksbury, is honorably and inseparably connected. In this method acidity is brought to bear through the medium of heated whey, which is applied to the curd in the cheese-tub. The curd is cut with a single blade to and fro throughout its depth, forming a 4 inch mash upon the surface, and is afterwards turned over from the bottom with skimming-dish and hand. The whole mass is then stirred about and broken into smaller pieces with a "shovel-breaker"—a four-fingered paddle, with wires across the fingers,—great care being taken to do this gently, so as not decrease the quantity of curd and make the whey white. A quantity of whey is next taken from the tub and heated to 140 degrees, during which the curd is broken into small particles like rice, and then sufficient of the heated whey is returned to the tub to raise its temperature to 100°. During the pouring in of the whey, which is not done too rapidly, the mass is kept in motion by the shovel-breaker in order that none of the curd-particles shall be scalded. When the mass has attained a temperature of 100° no more of the heated whey is poured into it, but it is kept in motion half an hour longer, until the curd has acquired a proper degree of consistency, which is indicated by a certain elastic granular feeling, on its being grasped in the palm of the hand. The agitator is then withdrawn, and the mass allowed to settle. In a short time the curd falls to the bottom, almost entirely separated from the whey, without pressure or mechanical force. The addition of the heated whey is technically termed "slip-scalding." Presently this heating was found to be better accomplished by hot water, or steam, instead of hot whey, and this was made to operate around and below the mass of curd and whey, through the agency of a cheese-tub having a space between the inner and outer shells, after the manner of the factory vats now in use in America, England, and elsewhere. But even now, though acidity was employed in the process its beneficial effect was scarcely ever suspected. The whey was not drawn off when acidity had advanced to a given point, for this was not ascertained; but, without any guiding *data*, it was drawn off when the maker's judgment dictated it. In the North of England I knew an extensive and very intelligent dairy farmer who effected a wonderful improvement in his dairy of cheese by the, with him, purely accidental expedient of keeping some curd over each day to mix with that of the following day. This kept curd acquired certain acidity during the 24 hours, and communicated it to the new curd with which it was mixed.

In the olden times when, as is claimed by some, cheese was made of a

quality superior to that made now-a-days, the farmer's wife was invariably the dairymaid, where there was a wife at all, unless one of the daughters was old enough to relieve the mother of the burden. In more recent times the cheesemaking has been commonly left in the hands of hired dairymaids,who may be pertinently supposed to take smaller interest in their occupation than the farmer's wife did,and who are less solicitous about the result. No doubt there is a strong *prima facie* truth in this argument, but it does not sufficiently explain the difference, for I have known many hired dairymaids make finer cheese than did the mistress to whose duties they had succeeded. I think a stronger reason for the average deterioration which has taken place in English cheese, during the last quarter of a century more particularly, lies in the system of "high-farming" which has been so commonly in vogue in this country during that period. By the use of various artificial fertilizers, and by the consumption by the cattle of linseed cake and other feeding stuffs, the herbage of our pastures has been quite changed in character, and has become possessed of certain qualities which have prejudicially affected the quality of the cheese when it is continued to be made on the old system. It has passed into a proverb, in this part of the country at all events, that "the poorest land makes the best cheese,"—so deeply are our farmers imbued with the belief that improved farming out of doors has resulted in disasters in doors. And it is emphatically true that the knowledge of handling milk most profitably has not advanced correlatively with the knowledge of producing it.

It is, however, true that there now is cheese made in different parts of England, and perhaps a greater bulk of it, which is of a quality quite equal if not superior to any cheese which was made in the olden times, either in this or any other country. It is the lower qualities which have so much increased in bulk, and these have lowered the average. And even now it seldom happens that a dairymaid who gives her mind to her work, and who is addicted to scrupulous cleanliness with regard to the milk-room and to the various utensils, fails to produce a very good quality of cheese. The fault lies in the fact that there are so few dairymaids who answer to this description.

In districts where cheese factories are in operation the average quality of the cheese has been considerably raised through their agency. The cheese made in them is itself far above the average quality of the cheese which was beforetime made in the farmers' own homes ; and they have acted as a stimulous to those who continue to make their cheese at home. In this latter respect they have done considerable good. But the factories themselves vary considerably as to the character and quality of their goods. Each factory manager seems to have a method of his own, to which he is wedded through preference or habit, and this method seems also, each successive year, to establish itself more firmly in his mind, so that if he is travelling down a wrong path it becomes increasingly difficult for him to leave it for a better one. I attribute this divergence of method in the different makers to the fact that they do not confer together and compare notes as you do in America, in your various dairymen's associations. An additional evil attached to this matter lies in the fact that the more they hold aloof the more suspicious and jealous do they become of each other. This is disastrous, and it involves heavy

losses to the farming community, more especially in some instances. To obviate this state of things we are attempting to establish a British Dairymen's Association, from which we pertinently expect to derive many important advantages. Notwithstanding the great improvements in cheese-making, which the factory system has undoubtedly largely aided in developing, things are yet in a chaotic state,out of which I suspect we shall find some difficulty in disentangling them. We are in a probationary condition, but the objects to be accomplished, though difficult, are not insuperable.

There are now some thirty cheese factories running in England, and you in America are probably surprised that they do not multiply more rapidly, in view of the very great improvement which they have brought about in the cheese of your country. I must now tell you why they do not.

Since the Adulteration Act came into force, the supply of milk in its natural state to our towns and cities has become an important factor in the calculations of all our dairy farmers who live within an easy distance of a railway, and now that cheese, more particularly than butter, is so much lower than it was in price, the superior returns derived from the sale of milk are naturally claiming increased attention. Our urban public can now obtain, when they ask for milk, an almost pure and unadulterated article. A few years ago, and with sufficient reason, the public had come to suspect that they were imposed on by every imaginable kind of adulteration, amongst which water was the least objectionable, and the consequence was that every family used as little of the so-called milk as possible. But since the passing of the Act in question the consumption of milk has enormously increased. It now enters largely into the food-list of every household, and is used in preference for many purposes from which it was erstwhile scrupulously excluded. It is daily increasing in popularity, and will continue so to increase so long as our law requires the supply of a pure article. At the present time the cheese trade is very much depressed, and there is every symptom that it will for some time continue so. It has gradually been going downwards for the past two years, and it is now supplied to us from abroad at prices which, to the English cheesemaker, are simply ruinous. As contrasted with milk, cheese is not a perishable article, and it can be conveyed long distances over sea without injury of any kind. Indeed it is by some stated that a voyage improves the flavor of cheese. In some cases this is no doubt true, while in others the opposite holds good. It follows, then, that as we cannot obtain fresh milk from other countries, while cheese can come to us from the antipodes, if need be, our dairy farmers will turn their attention more and more to the milk trade with the cities. And it is fortunate there is this alternative open to them, and that the demand for milk goes on, and will go on, rapidly increasing, or English dairy farmers must inevitably go to the wall. In course of time, not very far hence, I believe there will be very little cheese made in England, except in districts through which no railway passes ; and it is more than probable that even in these, butter-making and the raising of stock will to a great extent displace cheese-making.

At present there is a difference in price between good English and good American cheese of about four cents a pound in our markets. Your

cheese is as good as ours in every respect, and still there is this disparity in price. I can only account for it by attributing it to the prejudice which yet remains in the average English cheese-consumer's mind against American cheese, but this prejudice must inevitably die out with the present generation—probably with the older and stupider part of it. Such being the prospect for the early future, American agriculturists may with confidence go on reclaiming lands from the prairie and the forest, and devoting them to dairy purposes. Ninety per cent. of the cheese which our population will consume in years to come is destined to be supplied to us from America. It is true that you are now realizing very low figures for your cheese which is sent to us, but then all our trade throughout the kingdom is in a very depressed condition, and our working classes are earning very much lower wages than they were a year ago. Hence it follows that they have much less to spend, and when such is the case they cut down the commissariat, rather than relinquish various reckless pleasures and extravagances.

The conclusion I arrive at from the foregoing considerations is that cheesemaking in England is in a transitory state, and somewhat chaotic; so unsettled indeed is it, as to the position it will assume in the future, that means advanced expressly for its improvement and development are received by our dairymen in a half-hearted and perfunctory manner. But, in any case, there is still an amazing quantity of milk annually spoiled in this country by improper management, and any improvement which will obviate this national loss, be it the milk trade or improved cheese and butter making, will be a great boon to us. The cheese factories have done and are doing great good in teaching men how to handle dairy produce; but, for the reasons I have given, they are not likely to become very numerous in this country. Some of our existing factories are, however, at the present time, lending themselves very conveniently to the exigencies of the milk trade. In the summer, when the flow of milk is greater than the demand, they work up a portion or the whole of it into cheese, more conveniently than could be done under the same circumstances by individual farmers, while they act, in seasons when there is a demand for the whole or a part of their milk, as convenient receiving houses from whence can be despatched a greater or less quantity, as may be desired, to the wholesale dealers in our cities. It is already customary for the dealers to telegraph their requirements to the factory managers, who then send off the exact quantity of milk required. Confusion and loss are thus avoided. The price the factories now receive for fresh milk sent off to the cities is 8*d.* per gallon, whereas I doubt if any of them, had they made up the whole of their season's milk into cheese, could have paid at the end of it a dividend of more than 6*d.* per gallon to the contributors. An additional profit of twenty-five per cent. is an inducement worthy of notice, and it is probable that, in the future, all dairy-farmers who can, will dispose of their milk in a more profitable way than that of making it into either cheese or butter.

J. P. Sheldon.

Sheen, Ashbourne,
Derbyshire, England.

Convention adjourned to meet on Friday, at 2 p.m.

FRIDAY AFTERNOON.

The Convention met at the appointed hour. Owing to the attractions on the centennial grounds from public displays, the attendance was quite small, but the papers and discussions were interesting and animated.—The first paper read was an interesting history of the origin and progress of the Industry of Condensed and Preserved Milk, by Prof. E. N. Horsford, of Cambridge, Mass., as follows :—

Some months since I addressed the following letter to L. B. Arnold, of group IV., with whom I had the privilege for a brief time of serving as Judge in the group of conserves :—

"In any account of the industry of condensed milk which may be expected at the conclusion of the labors of the Judges of Group IV., it may be thought not to be amiss to include a glance at the action of the corresponding jury at the Vienna Exposition, where, in defending the claims of America in this field, I was made through accident to receive a larger share of credit than was my due, and where I did not lay claim to any.

"To place myself right in the matter, I addressed a letter to Dr. Thiel, Juror of the IVth Group, from the German Empire, which letter he has caused to be published in Dingler's Pol. Journal, and the substance of which I herewith enclose to you for such use as may seem proper to you. The day of awards at our Centennial is passed, and there can be no impropriety I conceive in the course which I pursue.

"In the discussion before the International Jury of the IVth Group at Vienna, in 1873, as to the propriety of awarding the Grand Diploma of Honor to the Anglo-Swiss Condensed milk Company, of Cham, Canton Zug, Switzerland, the fact came out without any preconceived purpose on my part, that I had independently solved the problem of preserving milk for commercial purposes, by condensation at a low temperature, with the addition of sugar. I was endeavoring to show that the credit of the invention as between Europe and America was due to the latter country, and that the product had been a commercial success in the Western World years before the foundation of the works at Cham.

"The Council of Presidents acting on the recommendation of the IVth Jury—a jury upon food—decided to award the Grand Diploma to the Company at Cham, and that the Diploma should state that the invention was due to Prof. Horsford, of America. Since the date of this award the justice of this decision has been called in question, and, as I think I have been credited with more honor than I deserve, I beg to place in your hands the following communication, which I believe presents a summary of the history of the subject, which I will thank you in any proper way to communicate to the public."

E. N. Horsford.

On receipt of the foregoing, Mr. Arnold, your Secretary, did me the honor to suggest that I should submit my communication to the American Dairymen's Association ; and in accordance with this suggestion I have presented myself to vindicate, perhaps I may say, the claims of America to the great industry of commercial milk condensation.

CONDENSED MILK.

At the time I began the investigation of the problem of preserving milk in 1849, I knew nothing bearing upon the subject except the experiment of Gay Lussac, mentioned in one of Liebig's lectures, by which milk had been kept sweet through a period—if I remember aright,—of more than one hundred days, by simply heating it to the boiling point each succeeding morning. There was then little of the literature of the Science or Technology of Europe readily accessible to me. The earlier numbers of the Annales de Chimie et de Phys. of Dingler's Poly. Jour. of the Pharm. cent. Blatt., of Buchner's Repertorium, and the Records of the French and English Patent Office, were not at my command. I was of course familiar with the use of sugar and syrup in the preservation of fruits, and Appert's exclusion of the air and sealing at the boiling point, were well known to me. I proceeded in my experiments upon the idea that if I could prevent molecular movement among the particles of the milk, I could prevent decomposition—prevent putrefaction and keep the milk sweet. Simple as this seems it was a long time before I succeeded in obtaining a preparation in the form of paste—or as a dry granular non-hygroscopic substance, or as a solid block, that would practically meet the wants of a commercial product. The necessity of conducting the evaporation at a low temperature was one of the first results at which I arrived. The reason is obvious. With a heat that would expel the water from the milk with the formation of bubbles of steam rising from the bottom, the caseine would adhere to the evaporating vessel and incipient destructive distillation would set in, imparting an objectionable, however slight, empyreumatic odor to the condensed product. With the addition of sugar and the gradual removal of the water any desired degree of viscidity might be imparted to the milk, and with the removal of the water carried sufficiently far, the product might be carried to the pasty, granular or solid condition. When I had established the two points of evaporation at a low temperature, and the requisite proportion of sugar to be added to the milk, I gave the invention to my assistant, Mr. Dalson, who soon after resigned his situation and turned his attention to the development on a working scale of the art of condensing milk. He devised an apparatus for evaporating by a current of air applied to the surface of the liquid kept constantly in agitation and heated by a steam jacket. After some year or more of experimenting, Mr. Dalson brought the subject to the attention of Messrs. Blatchford and Harris, of New York, who had, I think, been already engaged in experimenting upon milk, and who established extensive works in one of the milk districts within easy access of New York. Mr. Dalson patented his apparatus in 1854. The Messrs. Blatchford and Harris employed it. They paid the usual exaction for attempting to convert a mere scientific invention to practical use and working success: they lost a large amount of money, but they produced among other considerable amounts 600 lbs. of solid condensed milk for Dr. Kane's Arctic Exploring Expedition. This contributed, according to the testimony of Dr. Kane, to the most noble end of preserving the health of the officers and crew in their daring attempt to reach the North Pole. Of this quantity, fortunately, a small block in a condition of perfect preservation, though wrapped only in a loose paper, has been kept by

Mr. Blatchford, and now lies before me—twenty years since its preparation.

Mr. Blatchford devised improved apparatus involving the use of the vacuum pan, and the preliminary specifications for an application for a patent were drawn up by Judge Blatchford, now of the United States Supreme District Court, but want of funds prevented the further prosecution of the business.

In the same year, Aug. 19th, 1856, Gail Borden obtained a patent for a particular use of the vacuum pan for preparing condensed milk *without the use of sugar*. Mr. Borden prepared soon after, with the aid of a vacuum pan, and for years has continued to prepare large quantities of condensed milk, in the form of a thick-flowing semi-liquid mass, without the use of sugar, the article being designed for comparatively immediate consumption. It is not sealed up, but is transported in open cans and distributed like natural uncondensed milk to customers. At a later period Mr. Borden, also on a very large scale, put up condensed milk prepared with sugar and sealed in cans, for use at sea and general commerce.

In the discussion before the Jury of the IVth Group, at the Vienna Exhibition, in 1873, that accompanied the award of the Grand Diploma of Honor to the Anglo-Swiss Condensed Milk Company, of Cham, Canton Zug, there was some misapprehension of what I said in support of the claims of America to the honor of having been the first to introduce condensed milk as a successful commercial product from the similar sound of the names *Dalson* and *Borden*. The former was my assistant. The latter was at no time my assistant, though I find I was understood to say he had been.

To the former I gave the results of my experiments in preparing condensed milk with the addition of sugar and the evaporation with constant stirring at a low temperature and in the open air, and he proceeded to devise apparatus on a working scale for producing a commercial product. To the latter is due the first successful use of the vacuum pan in a preparation on a commercial scale, of condensed milk without the aid of sugar, for convenient transportation without sealing, and for speedy use, and also at a later period, of condensed milk with sugar and with the aid of the vacuum pan and sealing for indefinite preservation.

To myself is due the credit, whatever it may be, of having worked out as an original investigation the conditions and proportions of ingredients that had the fortune through my assistant Dalson, in the hands of Messrs. Blatchford and Harris to yield the first commercially successful condensed milk.

I am not aware that any commercial product, proved to be of permanent unchangeability, was in existence at the time my investigation commenced or for some half-dozen years thereafter, other than that based upon my researches. De Lignac's preparation, for some reason, seems to have failed of success, though in reading the account of his process it is not easy to see why, except that the times may not have been ripe for its successful introduction.

Since hearing the interest that has been taken in the subject, I have looked through such journals as are now but were not in 1849 accessible to me, and find in general a large measure of inventive effort and re-

search had been bestowed upon the problem of milk condensation and preservation before I undertook the investigation.

I give below a glance at the history of the invention, commencing with the Anglo-Swiss Condensed Milk Company, of Cham, Canton Zug, Switzerland, which, according to the Swiss catalogue prepared for the Vienna Exposition, was the *first* establishment for the condensation of Milk in Europe, and was founded in 1866.

Gail Borden's patent according to the Records of the United States' Patent Office, was taken out Aug. 19th, 1856, and was for an *Improvement in Concentration of Milk.* The Records say : "The nature of this invention consists in keeping the sweet milk to be concentrated in a vacuum vessel C, to keep the milk out of contact with atmospheric air, and in then concentrating said milk in a vacuum vessel B to prevent incipient decomposition in the constituent elements of the milk during the process of evaporation."

The inventor says : "I am well aware that sugar and various extracts have been and are now concentrated in a vacuum under a low degree of heat to prevent discoloration and burning.

"I am also aware that scalding milk to improve its preservative qualities has been long known, and that it has been kept in hermetically sealed vessels. I do not claim these processes.

"I am also aware that William Newton and many others since have obtained patents for concentrating milk by various modes of evaporation, and combining it with sugar to render it soluble and preservative. I do not claim this as my discovery or invention.

"But I claim producing concentrated milk by evaporation in vacuo substantially as set forth, the same having no sugar or other foreign matter mixed with it."

This patent was also taken out in England, under the title, "Improvements in concentrating milk and obtaining concentrated extracts from coffee and chocolate."

The next preceding patent was taken out by my assistant, Augustus F. Dalson, and is as follows :

"U. S. Patent Office Report for 1854, p. 458, No. 11,193, Augustus F. Dalson. Apparatus for Dessicating Alimentary Substances. Patented June 27, 1854.

This apparatus consists of a circular shallow evaporator, A. A. The substance treated rests in the circular border, depression, and an agitator *t.* and roller *r.* constantly produce a fresh surface of the liquid during evaporation. To aid in the latter, currents of of air are constantly drawn or forced over the surface of the liquid between the evaporator AA and the cover CC., and down through the central pipe P. The liquid is heated by the steam jacket BB. or steam-pipes *p.* or otherwise blown. The combination of the shallow pan A. with a rapid current of air underneath the cover C., and thence through the central draught pipe P., together with the apparatus for continual stirring by means of the revolving cover C., and its fixtures *tr* substantially as described.

Under this patent the condensed milk, in solid blocks, was prepared by Messrs. Blatchford & Harris for the Arctic Expedition of Dr. Kane, which sailed in 1856, as already mentioned. It was sent out for trial to California in 1852 and was successfully employed. It was proved by

Col. Eaton, of the U. S. Army and Commissary Ceneral in the late war, at the station of Albuquerque, in the Plains, in 1854. It was tried on shipboard and orders were filled from Liverpool.

The next preceding patent was the following :

Felix Louis took out a patent in England, May 6, 1848. He prepared solid cakes of condensed milk, adding 1-40 per cent. of sugar and concentrating at a temperature of from 176° to 194° Fahr.

Thomas Shipp Grimaud patented an invention in England. Nov. 13, 1847.

" Said invention consists in boiling milk in vacuo, so as to deprive it of the greatest portion of its aqueous particles while at a low temperature, having previously added a small quantity of saltpetre, and after it has been so boiled in admitting it into and confining it in bottles or other receptacles from which atmospheric air had been previously extracted, and in then securing the said milk from any readmission of such air into the said bottles or other receptacles until opened for use, and in then mixing the said milk with as much pure water as had been extracted from it, or other suitable fluid, and so making it fit for the purposes of nutriment again."

In October (7) of the same year (1847), J. J. B. M. de Lignac took out a patent in France, which was also taken out in England, March 10, 1848. De Lignac's process was warmly commended by Payen, after pronouncing adverse opinions upon the process of *Bracomiot* in which a part of the milk was lost, upon that of *Millenenoe* in which the butter was liable to separate, upon that of *Affert* for the same reason, and against that of *Robinet* which was to be regarded as that of a laboratory preparation rather than a commercial industry.

De Lignac condensed milk with constant stirring in shallow pans (3 inches depth of liquid,) surrounded with a steam jacket and heated with 1-16th of its weight of sugar, at a temperature from 186 to 195 degrees Fah., to one fifth of its volume. This preparation would keep sweet in open cans through fourteen days, and thereafter the interior would be found good after removing the outer layer.

The English patent provided for a concentration to *one sixth* of its volume. The formation of scum was dispersed with a spatula. Any splashing on the sides was not scraped back into the concentrating liquid.— The preparation had the consistency of honey.

Searles' Patent in 1843, (Repertory of Patent Inventions), Dingler's Pol. Jour. Vol. 89, p. 398, removes the cream and mixes 1-40th per cent. of sugar to preserve solubility, and evaporates over a water-bath, obtaining a perfectly dry product.

In March, 1835, Grimaud read a paper before the Academy of Sciences of Paris, upon *Lacteine.* His process of preparation consisted in letting the milk flow in a thin stream over a steeply inclined surface, against which a stream of air was forced to carry off by evaporation the water until only one-tenth remained. (Dingl. 1835, vol. 56, p. 474.) It is suggested in a note by the Editor of Dingler, that Grimaud is the foreign inventor in whose interest Wm. Newton took out in his own name the following patent :—

Sealed 11th March, 1835, by a foreigner through Wm. Newton. " I introduce into the milk a small quantity of pulverized loafsugar, say from one-

fiftieth to one-hundredth in weight of the whole quantity of the milk, which quantity may however be greater, dependent upon the desired sweetness of the preparation when completed. On the sugar becoming perfectly dissolved, I subject the milk to tolerably rapid evaporation, either by blowing through the milk warm or cold air, by means of suitable apparatus of any convenient form, such, for instance, as those at present in use for evaporating syrups, or by means of external warmth in connection with a vacuum above the surface, produced in any of the ordinary ways as applied to evaporation. By whatever process, however, the evaporation is carried on the milk may with advantage be subjected to a gentle warmth to quicken the operation ; but that warmth will be best obtained from hot water, or from steam or heated air applied to the outside of the vessel which contains the milk, as the direct action of fire upon the vessel may tend to injure the properties of the milk, and perhaps give it an unpleasant flavor. By evaporating the aquious parts of the milk in this way its nutritive or essential parts may be concentrated, and its substance reduced to the consistency of cream, honey, or soft paste, or even into dry cakes or powder ; and may in the latter states be kept exposed to the air for a length of time without being impaired, the sugar tending to preserve it.

In this specification we have, so far as I have been able to ascertain, the first recorded use of the vacuum pan in the condensation of milk.

Newton's principal used it, or contemplated using it,—for it seems to have passed out of recollection, without having been brought to a practical working test—in a manner so thoroughly scientific, that it seems now to have required only a little practical experience to render it wholly successful.

Kirchoff evaporated milk to dryness and then rubbed to powder. This preparation stirred with water gave a fluid much like milk, though not quite equal to it. The editor of Dingler tried the method but without success. (Dingl. Pol. Jour., Vol. 40, 1831, p. 62.)

Gay Lussac observed that where milk is heated to boiling daily it may be kept without change for months. (Bull. des. Sci. Agr., Aug. 8, 1830, p. 524.)

The following is taken from the Pharm. Cent. Blatt. for 1830, and is accredited to the Ann. de Ch. et de Ph. XI., III.

Braconnet took $2\frac{1}{2}$ litres of milk exposed to a temperature of 45°C., and with repeated stirring, added from time to time diluted hydrochloric acid, which separated all the caseine and butter from the "Serum" (the whey), that scarcely reacted upon blue litmus paper. To the so separated coagulum he added in successive portions 5 grammes powdered and crystalized neutral carbonate of soda, and gently heated when a rapid solution followed. The fluid had about the same acidity as fresh milk, and yielded about $\frac{1}{2}$ litre of a kind of cream, or rather of artificial milk (franchipane).

Braconnet prepared from this, aromatic cream of the most acceptable taste. Add to this kind of franchipane a quantity of water equal to that separated in the serum—the whey—and a quantity of common sugar, one obtains a fluid perfectly resembling milk, except that according to uniform judgment it has a more pleasant taste.

By heating the concentrated milk-like fluid with about an equal weight of sugar one obtains a remarkable fluid—an excellent, perfectly homo-

geneous milk syrup. By dilution with a pretty large quantity of water, one obtains a white, opaque fluid, quite like milk to which sugar has been added only of preferable taste. By concentration with constant stirring to a degree which avoids the separation of the butter, there is obtained a white confection, which, in an imperfectly closed can, will keep for a year without the slightest change. Dissolved in boiling water it serves at breakfast for coffee, which has a much more agreeable taste than that prepared with the best of milk. The process of Braconnet was not, properly speaking, a process of milk condensation. It was a method of utilizing the caseine and butter of milk, and converting them into a substitute for milk, which might be condensed with sugar, and in that condition kept without spoiling, for use with coffee and otherwise.

In 1826 Adolphe Anoclet Malbec, of Paris, rue du Foin Saint Jacques, No. 28, patented an invention of *portable milk*. The Records of the French Patent Office contain the following: "Milk to which one-sixteenth of pure sugar had been added is condensed in a silver vessel over a water bath under constant stirring with a wooden spatula, until a proof on a cold surface became hard and brittle. The whole was then allowed to cool and was wrapped in lead foil, or otherwise enclosed for keeping. It kept without deterioration for years. In order to use the preparation it was dissolved in hot water over the fire, in the proportion of three ounces or six table spoonfulls of substance in thirteen ounces of water."

The French Patent Records running back from 1826 to 1791, contain no other mention of a process for condensing milk. It is highly probable, therefore, that this invention of Malbec in 1826 is the first for preserving milk by concentrating with the addition of sugar. It was obviously a purely laboratory experiment, and no attempt was made to give it the proportion of a commercial production.

In summing up the work in this field it is proper to mention that the Carlsruhe Agricultural Union tested and approved many years ago a process devised in Bremen, in which the milk was concentrated to only half its volume. In each pound of milk $\frac{1}{4}$ to $\frac{1}{8}$th of a pound of sugar was dissolved, the product bottled, corked and wired, and then heated in a pan of boiling water for two hours. When wanted for use it was diluted with an equal volume of water.

It is proper to refer also to the process of Bethel, who saturated the milk with carbonic acid, bottled and corked; also to Fadeuilhe's preparation in solid form by steam heat, with constant stirring, with carefully regulated heat at different stages of concentration, from 160° to 170° Fah., and the addition of small quantities of sugar and gum arabic; also to Madru's process of filling bottles with milk by pouring through a funnel, with long neck reaching to the bottom, so as to expel all the air, then covering the milk with a thin layer of oil, and applying heat.

In looking over these various records, it is not difficult to believe that success might have come to the unknown inventor, whose invention of 1835 Newton patented in England, if he had had the means, business ability and patience to keep his product before the public till the value and convenience of the condensed milk were fully appreciated. In a certain sense the invention was made too soon.

The use of sugar with the milk and the evaporation at a low temperature with agitation to prevent coagulation of caseine at the surface, and

separation of the butter from its superior levity, seems to have been recognized as essential by almost all who tried to impart preservative qualities to the milk by condensation. But the publications in which the invention appeared had but a limited circulation, and the same invention continued to be repeated, each invention being quite independent and original so far as his predecessors were concerned.

It was perhaps at the best my good fortune to live nearer the period when the invention was called for, by the wants of increased commerce at sea, and the necessities of exploring parties, than those laborious investigators who preceded me in their study of the same problem.

It happened to me to be instrumental in determining the conditions of success and to have them demonstrated through a successful commercial venture, and to possess a still preserved sample of the condensed milk made by my process after twenty years keeping without other protection from the air than a simple envelope of tin-foil.

E. N. Horsford.

ADDRESS ON THE USE OF BORACIC ACID AND OTHER MATERIALS FOR PRESERVING MILK SWEET.

BY PROF. G. C. CALDWELL, OF CORNELL UNIVERSITY, ITHACA, N. Y.

During the hot season of the year there appears to be a need of some means of keeping milk sweet for a few hours longer than it will naturally remain in a good condition, especially in the case of the transportation of milk from the country to the city.

In a short contribution to the proceedings of the American Dairymen's Association last winter I gave a very brief account of the use of Salicylic Acid and of Borax for the preservation of milk. The papers of Kolbe and others on the powerful antiseptic properties of salicylic acid, have been very widely noticed in the scientific and popular journals and have excited much interest, especially since pure salicylic acid has neither taste nor odor, so that it can be used for the preservation of articles of food, as its nearest associate, carbolic acid, cannot be, unless very pure. Some quite remarkable results have been obtained in respect to its application to the preservation of milk; a sample of milk with 1-2500th of its weight of the acid added to it remained sweet 36 hours longer than milk without such addition. In another experiment the addition of one part of the acid to 5,000 of milk, retarded its souring for the space of from 20 to 24 hours, and when one part of acid was added to 2,000 of milk it remained sweet, at a temperature of about 65 Fahr., from 2 to 4 days longer than did a similar sample with nothing added. But in some experiments of my own that I performed last winter, where the milk was kept at about the same temperature, I could not get any such favorable results although the trials were repeated several times; even when one part of acid was added to 500 of milk it turned sour in 48 hours, and when the proportion was 1 to 1250 the milk soured in 36 hours.

Soxhlet, a prominent investigator of the properties of milk, seems to have obtained results similar to mine, for he gives it as his opinion that if the proportion of the acid added is kept so low as to avoid communicating any taste to the milk, its preservative action is of no account. It

may be that those experiments which resulted so favorably were made with the pure acid. I used the commercial acid, for the chemically pure article would be too costly to be used on a large scale for any such purpose as this.

I might add that I found that it made no difference whether I added the solid acid and stirred it into the milk, or whether I used a solution of it.

But even those who have obtained such good results in applying this antiseptic to the preservation of milk do not speak with a corresponding degree of favor of its use in practice, for the reason that it is but little more effectual than other substances that are much cheaper; the one thing that they do say in its behalf is that the cream from milk to which salicylic acid has been added is better in consistency and taste than that from pure milk.

It has been known for a long time that borax possesses remarkable antiseptic power; for a substance with such mild properties, it appears to be singularly destructive of the life of the minute organisms that are supposed to be concerned in the processes of fermentation and putrefaction, similar to those which go on in milk as it sours and becomes offensive with age. In the case of some recorded experiments, grapes kept in a solution of borax suffered no fermentation for two years; meat in a solution of borax remained unaltered for a very long time, so far as the putrefactive changes are concerned, which attack such a substance very speedily if left to itself. It would be natural to expect that the changes which milk suffers spontaneously would be opposed in a similar way.

In one experiment, milk to which 1-30th of its weight of borax had been added retained the odor and appearance of fresh milk for months, and it did not become sour. But no such proportion of this substance can be used in actual practice, for it would communicate a disagreeable alkaline taste to the milk that would be no less objectionable than the taste of the sour milk. In some experiments of my own I found that 1 part of borax could be added to 500 of milk without notably affecting its taste, and that at a temperature of about 65 or 70 Fahr. Milk containing this proportion of Borax remained sweet 40 hours in one case, and 56 hours in another; in two other experiments, in which the proportion of borax to milk was 1 to 1,000, the milk remained sweet 48 hours, and with the proportion of 1 to 250 the milk acquired a disagreeable alkaline taste but remained sweet 96 hours.

During the hot weather of last summer I repeated some of my experiments with borax, and at the same time I made some further experiments with boracic or boric acid. In the first series of experiments the temperature ranged from 80 to 86 degrees in the day-time, and milk without any addition turned sour in from 20 to 22 hours; I found that under these circumstances, if the quantity of borax added was kept as low as was necessary to avoid affecting the taste of the milk, the souring was retarded to some extent, but not greatly; on the other hand, milk with 1-500th of its weight of boracic added to it remained sweet 50 hours, and the taste of the milk was not affected at all by the substance added.

In another set of experiments with boracic acid alone, with the temperature ranging from 72 to 79 degrees, and with pure milk turning sour in 24 hours, 1-1,000th of boracic acid added to the milk caused it to re-

main sweet 42 hours. In most of my experiments with this antiseptic the addition of a smaller proportion than 1-1,000th appeared to have but little effect; in these same experiments, for instance, where the addition of 1-1,000th nearly doubled the time that the milk would remain sweet, the addition of 1-2,000th retarded the souring by only 3 to 7 hours, or, in other words the time that the milk would remain sweet was increased by only from 1-3rd to 1-7th of the length of time that it would keep without any addition.

On the other hand the addition of more than 1-1,000th served to increase the time that the milk would keep, somewhat in proportion to the amount added; for instance, in the case of the experiments where the addition of 1-1,000th nearly doubled the time of keeping, the addition of about 1-650th nearly trebled the time, making it 66 hours instead of 42.

In the last set of experiments that I made, where the milk was put in a warm place in my laboratory, the day temperature ranging from 61 to 78 degrees, and probably not falling below 60 in the night, the milk without any addition soured in 40 hours; with 1-1,000th of Boracic added it remained sweet more than 72 hours, and at 90 hours it was sour but not curdled; with 1-800th of acid it was only just beginning to turn at 90 hours, and with 1-650th it was still sweet at 90 hours.

The boracic acid used in these experiments was the ordinary acid of the druggists costing 50 cents a pound; it occurs in the form of pearly crystalline scales which are not readily soluble in cold water, but are quite soluble in hot water; the solution has a very feeble acid taste, and is in fact almost tasteless. In all my later experiments, the milk taken while still warm from the cow, was divided into portions of about 1-10th of a quart in some of the series, and in others about 1-5th of a quart. The acid was added in the solid form, and well stirred in to make the solution as complete as possible, the dishes were loosely covered to keep out the dust, and were then set aside in a warm place; the milk in each dish was tasted from time to time, and as soon as the first semblance of a sour taste appeared in any case the time was noted; I did not wait till the milk curdled, as did most of those who have tried similar experiments before me, for my object was to determine how long the milk would retain its natural taste under the influence of the various antiseptics that were tested.

For the purpose of comparing boracic acid and borax with some other substances that are sometimes used as antiseptics, I made some trials with salt, with sulphate of lime and sulphate of soda, in different proportions; but none of these substances were found to exert any notable action in retarding the souring of the milk.

It may be said that the addition of any of these preservative agents to milk would be equivalent to an adulteration of it, and that the practice would therefore be a censurable one; but it seems to me that, provided the substance added is one which of itself is quite harmless, no injury is inflicted on the community by its use; as long as the milk retains the normal proportion of each of its ingredients, and is sweet and good to the taste what difference does it make whether it is 5 or 50 hours old? I am not aware that milk becomes any less digestible or healthful as it grows older; I can see no reason why it should not be just as fit for con-

sumption when old as when new, as long as it is sweet and its composition is essentially unchanged.

To my mind then, the answer to the question whether it would be a crime to add borax or salicylic acid or boracic acid to milk, turns upon the other question whether these substances are entirely harmless.

Both borax and salicylic acid are used as medicinal remedies, but it may well be questioned whether the small quantities that would be taken into the system in all the milk preserved with their aid that one could drink during the short hot season when, and when only, there would be any need of using them, would have any noticeable effect. Since, however, the most useful agent for this purpose seems to be the boracic acid, I have confined my attention in this respect entirely to that substance.

In consideration of the rather high price of the acid it is not likely that the milkman would use any more than just about enough to accomplish his object in adding it to the milk—that is, he would not be likely to add more than from one to two parts of the acid to a thousand of the milk. We will take an extreme case, and suppose that a man could consume in one way or another a gallon of milk a day, which is certainly a liberal allowance for those who have to buy all their milk, and that this milk was kept sweet and good with the aid of a proper dose of boracic acid; in this case the man would consume with the milk a quantity of boracic acid ranging from 1-14th to 1-7th of an ounce, according to whether one or two parts of the acid was added to a thousand of the milk. Can this or even a larger quantity possibly affect him in any way?

In all the accounts of the properties of boracic acid in the works on chemistry, no mention is made of any effect that it produces on the animal system; hence it cannot be a poisonous substance: no mention is made of it in the dispensatory, and hence it has not yet been found to possess any medicinal virtues; if it has any medicinal properties they cannot be the same as those of borax, in which the acid is combined with the base soda, forming a compound with strong alkaline properties; the medicinal action of borax is attributed, at least in part, to this alkaline property. In the absence of more positive information in regard to the matter in question, I have made a few experiments on myself with the acid; during the past two weeks I have taken several doses of about 1-9th of an ounce, and I was not able to see that it produced any effect upon me; I remained just as well as ever, and none of the vital processes appeared to be interfered with in any degree. The common opinion that the acid is perfectly harmless when taken internally may therefore be regarded as correct.

To sum the matter up, I have shown that the use of either the salicylic acid or borax for preserving milk is not practicable, while boracic acid added in proportions at least as large as 1-1,000th by weight is very effectual as a preservative—that added in this proportion it will usually serve to keep the milk in a good condition about twice as long as it will remain sweet without any preservative, but kept under the same circumstances otherwise—that this acid can be added in still larger proportions without affecting the taste of the milk, and that its preservative effect increases somewhat in proportion to the quantity of acid added—and finally that a much larger quantity of the acid than any one would be likely to take with a most liberal consumption of milk that has been kept

sweet by means of it, would produce no perceptible effect on a healthy person.

The following paper was read by Bernhard Osann, of New York City :

ON THE UTILIZATION OF WHEY.

In Switzerland, Germany and other whey producing countries, all or nearly all the whey is converted into lactic acid, sugar of milk, &c. The method there employed is to evaporate or boil down the whey until a dry residuum is obtained. This crude product is carried to some centrally located refinery to be purified. Why could not this be done here also? All large cheese factories produce large quantities of whey, most of them have steam heating appliances and could easily condense the whey in a steam kettle or vacuum pan. If, after filling up the kettle, as often as practical, the remaining liquid were boiled down till a thin skin formed on the surface and pieces of string hung therein, upon being allowed to cool, the sugar of milk would crystalize upon the strings like rock candy. These crystals could then be removed, allowed to drain, and would be tolerably pure. The remaining liquid could be used in future condensations. If this operation were conducted over an open fire instead of in a steam kettle, frequent stirring would be necessary. Will it pay? Milk for cheese manufacturing is worth about $1.00 per hundred lbs. Ordinary milk contains about 5% of sugar. Say, that one hundred lbs. of milk would yield 4 lbs. of purified sugar ; this is worth at least 15 cts. per lb. or 60 cts. A very high estimate for the purification of the crude sugar, obtained as above described, would be 10 cts. per lb. or 40 cts. Thus leaving 20 cts. to be added to the dollar obtained for cheese. It seems plausible that crude sugar of milk can profitably be made for 5 cts. a lb. when salt is produced from a much weaker solution, for less than 1 cent. It needs only to be added that the consumption is large and increasing, while the above estimate assumes a minimum standard of value throughout. In order to make a practical test of the feasibility of the above plan and with the hope of creating a universal interest and promoting investigation of the matter among dairymen generally and cheesemakers specially, Smith's Homœopathic Pharmacy, of 107 Fourth Ave., New York, a firm engaged in purifying and pulverizing the *imported* sugar of milk, will make the following offer : Let any one with the facilities at their command, make, in the above described manner, a quantity, be it large or small, of crude sugar of milk, send the same to the above address, and they will pay the freight upon the same and credit the sender with 15 cents per lb. for the material. The cost of purification, which, they guarantee, shall not exceed 10 cents per lb., will be charged to each lot, and the balance be subject to the order of the sender. They make this offer to demonstrate their faith in the plan, not presuming that there will be any immediate material benefit to either of the parties interested. Hoping that this will receive your careful consideration, it is respectfully submitted by the undersigned,

BERNARD OSANN.

The following address was delivered by Prof. James T. Bell, of Belleville, Ontario :

ADDRESS.

It seems to me almost an act of presumption in myself to stand up to speak in this place, where my humble effort will be brought into contrast and comparison with the finished productions of some of the ablest and most acute minds, delivered by some of the most eloquent orators of this great country, and I much fear that most of my hearers will entertain the same opinion; but my friends and fellow-countrymen have assigned to me the duty of addressing you, and I shall proceed to obey their behest to the best of my knowledge and ability, trusting to your kind consideration to overlook any deficiencies, and pardon any solecisms that you will doubtless discover, and to accept what I have to say in the same spirit of candor and kindliness in which it is offered.

The co-operative or factory system of dairy husbandry in Canada is the offspring of that of the United States, and though it has yet scarcely reached its adolescence, it has already attained such proportions as to give fair promise of becoming a child not unworthy of its distinguished parentage, and perhaps it may be as interesting as anything else that I could advance if I recapitulate the causes which induced and the circumstances which accompanied its adoption into the system of our agricultural industry and its rapid development after its introduction.

Some twenty years ago a gentleman from the dairy district of the State of New York purchased a farm in the Western Section of what was then known as "Upper Canada," and established a cheese factory on a small scale. Others in the succeeding years followed his example, and several factories were successfully brought into operation, but the movement was for a long time confined to the locality in which it originated and its immediate neighborhood, and it was not until 1865 that the joint stock system became generally adopted throughout the Provinces of the Dominion.

When your Government, in a moment of irritation, annulled the treaty under whose provisions the commercial relations of the two countries had been conducted during the preceding decade, the effect of their action was directly contrary to what they intended and expected. Instead of reducing Canada to an abject dependence upon the commercial policy of the United States, it taught her people to feel and recognize their own strength and capabilities, and to make the grand discovery that they had within themselves all the elements of commercial success. Before the abrogation of the treaty, our merchants were content to do their trading chiefly with and through the merchants of the United States; but when the support of your strong arm was withdrawn, and Canada had to guide her tottering footsteps without its powerful aid, she quickly found, to her own astonishment, that she could go alone, and her strength increasing by its exercise, that she could even compete in the markets of the world with her former patron and supporter.

At first, however, the announcement of the action of Congress was received by our population with feelings of doubt, and almost of dismay, and it was only a few far-forseeing and sagacious individuals who could appreciate the real bearing of the situation, and recognise in it an opportunity of securing for Canada an independent position in the commerce of the world; who saw that as the relaxation of the chain that had so long bound the commerce of her dependencies to that of Brit-

ain, had resulted in immense advantages to those of her colonies which were strong enough and wise enough to profit by the liberality of their mother country, so in like manner was it certain that the termination of our connection with, and consequent subservience to the commercial system of the United States, afforded an opening which, properly cultivated and improved, would tend to establish the commercial autonomy of the Dominion on a broad, a firm, and an infrangible basis, and elevate our country from the semi-dependent position she occupied under the treaty to the place which alike from her ancestral traditions, her natural advantages, and the enterprise and energy of her people, she is qualified to assume among the mercantile communities of the world.

Do not, however, suppose because I speak thus, that I or any of my fellow-countrymen are averse to the holding of friendly trade-relations with you, our nearest, and indeed our only neighbors. On the contrary, we are sincerely desirous to trade with you on terms of mutual advantage, and are ready to enter into treaty stipulations to that effect; but those terms and stipulations must be such as it may become a free and independent people to enter into with a free and independent nation. Terms and stipulations not negotiated in a petty spirit of bargain-making, grasping at undue advantages on either hand, but conceived and carried out in that grand spirit of honor and rectitude which for so many ages marked the course and stamped the renown of the merchant princes of that country from which we derive our common origin, and whose reputation we ought equally to cherish as a precious heir-loom to be preserved from diminution or disgrace.

Previous to the year 1865, as I have already stated, there were several cheese factories in operation in that part of Ontario which lies west of Toronto; but up to that time none had been established in that part that lies east of that city. In the agitated state of public feeling occasioned by the abrogation of the treaty, which caused our farmers to fear, not without apparent reason, that they would be thereby deprived of a market for a large portion of their produce, at the same time that they observed a manifest falling off in the productive power of the soil in many of the older settled districts of the Province, one of our prominent public men, the Honorable Robert Read, resolved that he would endeavor to find some means of reviving public confidence, which had been rudely shaken by apprehensions of approaching evil, and of mitigating any ill effects that might arise from the sudden disturbance of our commercial connections.

Having on a previous visit to the northern section of the United States observed the operation of the cheese factories, and justly appreciated their important bearing upon the condition and prospects of the agricultural portion of the community, so highly had he estimated the advantages they afforded, that on his return he had made a standing offer of a bonus of $100 to any person or company who should establish a cheese factory on the American plan in the County of Hastings; he therefore came to the conclusion that the introduction of that system was more likely than any thing else that he could think of to effect the end he contemplated.

He next consulted with Mr. Ketchan Graham, who subsequently represented the West Riding of Hastings in the Legislature of Ontario, and the result of their conference was that Mr. Graham, in company with

Mr. Read, Junior, took an extended tour through the dairying district of the State of New York, in the course of which they made themselves thoroughly acquainted with the constitution of the Dairy Companies there existing, and with the practical management of their factories.

On the return of these gentlemen, Mr. Read, Senior, and Mr. Graham resolved to try the experiment of establishing a model factory on the American plan, with such modifications as might be required to adapt it to the circumstances of our own country. They therefore procured a suitable building, purchased the necessary apparatus and utensils, engaged a skilful operator from the States to conduct the manufacture, provided between them one-half of the number of cows necessary to supply the requisite quantity of milk, and the "Front of Sidney Cheese Factory" went into operation in the year 1866.

The example thus set was quickly followed. The farmers of Hastings became aware of the beneficial effect of cooperation, and cheese factories sprang up in all directions, all of which are now working successfully; and the movement is still spreading every year shewing in increase in their number, until at the present time there are over one hundred factories in operation in the Belleville district, which comprises the counties of Hastings, Prince Edward, Northumberland, and Lennox and Addington. There are 50 which ship their cheese from Kingston and Gananoque, and at least 100 around Brockville and Prescott. Between Belleville and Toronto there are fifty more; and I cannot estimate the number in the section of the Province lying between Toronto and the shores of Lake Huron, in which are situated the head-quarters of the business, at less than those of the eastern section, which would make a grand total of 600 cheese factories in active operation in the Province of Ontario at the present time. Of course the factories vary very much in extent and capacity, ranging from 60 to 600 cows, or more. Take for instance the report of the "Sweet Briar" Cheese Factory, situated in the sixth concession of the Township of Rawdon, in the County of Hastings, for the year 1875, which I select, not because it is the best I can find, but because I consider it to be a fair average example of our factory reports, and the readiest to hand:

"Number of cows, 360; milk received, 850,121 pounds; cheese manufactured, 91,912 pounds; average price received $10\frac{9}{10}$ cents per pound; taking about $9\frac{1}{4}$ pounds of milk to make one pound of cheese. This factory is private property, and the cheese was manufactured for a cent and a-half per pound."

It is too early in the season to ascertain, or even to estimate the extent of the make of this year; but the quantity of Canadian cheese sent to market in 1875, as furnished to me by the shipping agents at the various stations along the Grand Trunk Railway and the steamship agents at Montreal, was as follows:—

East of Toronto,....	246,154	boxes,	weight,	16,000,000	lbs.
Toronto, ...	73,251	"	"	4,966,808	"
West of Toronto....	424,824	"	"	27,613,560	"
	744,229	"	"	48,580,368	"
Value at an average of 10c. per lb... ...				$4,858,036	

No better illustration of the great and growing importance of the Canadian cheese manufacture can be adduced than that afforded by a comparative statement of the quantity received at Montreal for export in the years 1872,-'73–'74, and '75, which is returned as follows:—1872, 195,031 boxes; 1873. 383,721 boxes; 1874, 375,903 boxes; 1875, 542,140 boxes; shewing the receipts of last year to have exceeded those of 1872 by 347,009 boxes, or taking the average weight of each box at 65 lbs., that the quantity of cheese received at Montreal has increased from 12,677,015 lbs. in 1872 to 35,239,100 lbs. in 1875; that is, an increase of 178 per cent. in three years, or two and three quarter times the quantity exported in 1872.

It must also be remembered that the shipments from Montreal do not include the whole of the cheese made in the Province over and above the home consumption. In winter, when the navigation of the St. Lawrence is closed for several months, all the cheese freights per the Grand Trunk go to Portland, and throughout the season a considerable amount of our western cheese finds its way to the sea-board by the United States railways, so that we cannot err in stating the total increase of the three years at 200 per cent on the export of 1872.

Our trade in butter, though it has been vastly outstripped by that of cheese, is also growing gradually larger, the increase from 1872 to 1875, being from 142,380 packages in the former year to 157,097 in the latter, or at the rate of 24 per cent. in three years, or 8 per cent. per annum. As the packages vary in weight from 60 lbs. to 120 lbs., the larger ones predominating however, if we average them at 100 lbs. each, we shall probably be nearly correct, and the quantity for 1875 will be 15,709,700 lbs., which, at 18 cents per lb., will give $2,827,746.00, and the total net cash value of the two articles will be

Cheese,....	48,580,368 lbs.	at 10 cents	per lb.,	$4,858,036.00.
Butter,....	15,709,700 "	18 "		2,827,746.00.
				$7,685,782.00

A very pleasing and beneficial feature connected with the dairy business, for which we are also indebted to the example of the dairymen of the United States, is the holding of annual conventions, in which all parties interested in the business, whether as producers, dealers or consumers, may meet together to interchange opinions, relate experiences, discuss points of practice or questions of principle, give and receive information, awake emulation and enthusiasm among themselves, and interest the public in their pursuits, and finally insure that whatever improvements or discoveries may be made by individuals may become the common property of all.

In the year 1868 some of the chief promoters of the dairy movement in Western Ontario, having observed the advantages attendant upon such conventions, formed a society for the purpose of promoting the interest and extending the knowledge of the art of cheese making. They adopted the style and title of "The Canadian Dairymen's Association," and obtained a grant of money from the Ontario Government to aid their endeavor. They held their annual conventions in the Town of Ingersoll. In 1872 the cheese-makers of the Eastern section of the Province formed

themselves into a similar society under the name of the "Ontario Dairymen's Association," established their head-quarters in the Town of Belleville, and applied for a similar grant. The Hon. Minister of Agriculture and Public Works was, however, unwilling to subsidize two rival associations, and under his advice the two societies coalesced in 1873, and became united under the name of "The Dairymen's Association of Ontario," the annual conventions of which are held in rotation twice at Ingersoll and once at Belleville in every three years.

For myself, I am disposed to assign a very high value to the effect of these conventions upon the successful cultivation of the manufacture of dairy products, and I think that upon a candid and impartial review of what has been done in our own Canadian conventions, most intelligent persons will be disposed to agree with me in that opinion; and of course the same estimate applies in a still higher degree to the larger assemblages you command on this side of the boundary line. The money value of any commodity depends largely upon its reputation for superiority over others of the same class, and such a reputation is only attainable by excellence of quality. This it is that causes certain brands of cheese and butter to command an extra price in the markets where they are known, and makes buyers anxious to secure the products of some factories rather than that of others. Hence it appears that in order to attain a national reputation, a reputation which shall extend to the whole produce of a country, the quality must not only be excellent, but it must be uniform in its excellence, so that the consumers may feel confident that in purchasing a certain brand of goods, they will be sure of getting an article which will suit their tastes and fulfil their expectations. And when we consider that a reputation of this kind is not a mere matter of sentiment, of emulation or vaunting among the makers, or even of a gold medal or certificate of commendation at an Agricultural Fair, but that it carries with it a hard cash value of from one to three cents a pound upon millions of pounds, that is from ten to twenty-five per cent upon the whole product of a country, we shall begin to understand how desirable it is for any producing country to possess a merited character for uniformity of excellence in its staple commodities, whatever they may be, and how advisable it is to employ every means that may promise to work effectually in that direction.

Not only have these meetings proved instrumental in promoting this great direct benefit, the means and proofs of which I shall presently consider, but their influence has extended beyond the circle of those immediately interested in the business, and created a constantly increasing interest in dairy affairs among the public at large. As an impulse communicated to still water spreads and widens, until the whole surface of the pool is agitated by numberless ripples, so the proceedings of these conventions have aroused in the public mind a deeper interest in the progress of the manufacture, and a more critical appreciation of the quality of its products, which has induced a larger consumption of its staple, and a greater readiness to pay a corresponding price for a first-rate article.

I shall now enumerate some of the means by which these desirable results have been striven for, and partially attained, although in doing so I shall be obliged to repeat much of what I have already said in our own conventions. In the first place, the operators and patrons of our

factories have had the advantage of listening to addresses from the Hon. X. A. Willard and Professors Arnold and Caldwell, gentlemen who possess a thorough knowledge both of the practical and scientific aspect of the manufacture, so that in their teachings they can not only describe with unerring accuracy the several processes and their normal results, but can give the ratios and explain the reactions which occur during the conversion of milk into cheese and butter, and thereby enable our operators to combine theoretical intelligence with their practical skill. Who can indicate the difficulties and troubles which our operators have to encounter, and the most approved methods of averting or overcoming them ; and who have defined the nature and traced the development of those obscure microscopic organisms, the moulds and ferments, bacteria and vibriones, which occasionally oppose such formidable obstacles to the success of the operator, and even imbue his wholesome and nutritious products with the seeds of disease and death.

In addition we have enjoyed and profited by the shrewd remarks and genial humor of the Hon. Mr. Lewis ; the keen observation and business tact of Mr. Burrell, of Little Falls ; the lucid and able exposition by Professor Wetherall, of the physiological peculiarities of the different breeds of cattle, and their comparative value for dairy and other purposes ; the broad commercial views of Mr. Peters, of the "New York Grocer," and the valuable experimental results, detailed with logical precision, of Mr. Hardin, of Kentucky ; while on our own side we have had displayed the practical knowledge and experience of Messrs. Ballantyne, Noxon, Chadwick, Casswell, and others, and I myself have had the opportunity of adding my mite to the fund of information which has flowed as freely from the platform of these Conventions as water from a spring.

In order to prove to the complete satisfaction of any reasonable person the beneficial effect of these meetings, I need only to enumerate the subjects which in turn occupy the attention of the audience, and narrate the manner in which they are treated. First comes the reading of an official address, in which is reviewed the business events of the year ; next the discussion of subjects selected by the Council of the Association, which are generally assigned in the first place to persons who are known to be qualified to treat them intelligently ; but which discussions are afterwards open to all who have a remark to make, a suggestion to offer, or an item of information to obtain. This is a very valuable feature, as in these discussions the more important and critical processes and operations are described by practical men, and the principles on which their success depends are explained by their more scientific coadjutors ; and it must be remembered that to obtain the best possible results in any operations which are based upon chemical affinities and combinations, theory must regulate practice, and practice must be guided by theory, and that operator will be most successful who has the most thorough knowledge of the nature and composition of his materials, and the effect produced upon them by his processes, for he will perform his operations with confidence, and will obtain the desired results with certainty, subject only to the derangements of accident, or the mysterious seasonal and atmospheric influences which occasionally defy and defeat alike the skill of the operator and the knowledge of the philosopher.

It is clear then that the more widely we can diffuse correct information the more thoroughly we can combine scientific knowledge with practical skill among our dairy population, the higher we shall raise the grade both of operators and patrons, and the higher degree of excellence, and of uniformity in excellence, will be attained by the products of their labours,

A very interesting, and by no means the least instructive, and profitable part of the proceedings, is the question drawer, to which every one who has a doubt to solve, a difficulty to surmount, or a special piece of information to gain, may contribute his query, with the full assurance that it will receive due attention, and that all that is known by those present respecting it will be brought out without further trouble on his part; while if he still requires further explanations, he is in the best possible position to put such questions as may elicit the information he may require to satisfy his mind, or to guide his practice.

I shall now endeavor briefly to recapitulate the work that has actually been done towards this end; for it is useful in science and art, no less than in morals and religion, to make an occasional retrospect of what we have done, in order that we may be able to ascertain clearly the progress we have made, and to estimate correctly the deficiencies we have yet to supply. And here I would premise that although my experience has been confined to our Canadian conventions, I do not doubt that my remarks will apply in an equal, or perhaps in a greater degree to those which you have been in the habit of holding in your more extensive and older establishtd dairy districts.

In our conventions then, the chemical, physiological, mechanical and commercial aspects of the business have all in turn come in for a share of attention. The nature, composition and constitution of milk have been fully and exhaustively explained. The various influences which affect it, either for good or evil, and the effects they induce, have been discussed and made known; the fungi or moulds, and other minute organisms, which have the power of producing such unexpected, and in some cases such prejudicial effects, have been systematically described, and their forms and transformations, as displayed by the microscope, have been made palpable to the eye in well executed diagrams. The several processes used in the factories have been thoroughly and critically discussed, and the methods and observations of some of the ablest and most successful operators have been fully and freely related. The difficulties met with in the course of the manufacture have been pointed out, and the most likely methods of avoiding or overcoming them have been indicated: especially that great bugbear of the factories, "floating curds," has received a large share of attention; its causes have been investigated, and precautions to prevent its occurrence, and remedies to remove its presence, have been suggested. The effect of temperature upon milk, the most advantageous way of cooling it down to a proper pitch, and of keeping it cool; the best mode of conveying it to the factories, and the proper degree of heat at which to apply the rennet, have all been considered. The curing and keeping of the rennets, the preparation of the solution for curdling the milk, and the proper quantity to use have been dilated upon. The construction of the curing-rooms, and the management of the cheese upon the shelf, as also the size and color suitable for different markets, have been debated. Opinions have been expressed as to the best kinds

of annatto, and for and against its use. The properties and capabilities of various pieces of machinery and apparatus have been canvassed, and their comparative merits estimated. The selection of dairy-cattle, both with reference to breed and individual qualities, has received marked attention. The food of the cows, both liquid and solid, as well as their general treatment, and the manner in which they are housed in winter, and the effect of these circumstances on the quantity and quality of their milk, have been expiated upon at some length, and the danger of allowing them to eat mouldy, half-decomposed food, or to drink foul and stagnant, or other unwholesome water, has been strongly insisted on.

The reciprocal duties of the farmer and the factory operator have been clearly defined. Of the farmer to supply his cattle with a sufficiency of good and wholesome food and water, to provide for them proper shelter in winter, and shade in summer, to avoid all harshness or cruelty in their treatment, and never to suffer them to be hurried and hunted with dogs, or by idle boys, to and from their pastures, so that their milk may be sweet, pure and natural, and free from any feverish or unwholesome taint or tendency, and especially from the germs of those dangerous and insidious animal and vegetable organisms which, when they occur, induce such loathsome and deadly diseases. To observe the utmost attainable cleanliness in regard to all cans, pails, strainers, dippers, and all other utensils used about milk; to wash them very clean with a warm water softened with soda or potass every time after using, and after such washing to scald them thoroughly with water at a full boiling heat, letting them be cool and thoroughly dry before again putting milk into them.—Above all to practise the strictest honesty in dealing with the milk; to send to the factories no skimmed or watered milk; not to keep back the strippings; and rigidly to refrain from mixing in the cans the milk of any animal which shews the slightest symptom of disease; remembering always that if you desire to attain the best possible results, that is to obtain the highest market price for your manufactured article, you must supply your operator with the best and purest material within your capability, and then if he fails to produce a satisfactory commodity, pronounce him incompetent, and employ a better qualified person; but do not condemn any one for a failure the cause of which lies in your own act and deed. The duty of the operator has been defined to be to use the best processes he can learn or discover, and to keep himself so well posted in the knowledge and principles of the business as to pronounce intelligently upon any so-called improvements, so as to determine whether or not it is worthy of being adopted; and generally to use the materials supplied to him to the greatest possible advantage, so as to improve the quality of his cheese and establish the reputation of his factory.

It is more difficult to define the duties and responsibilities of the dealers; but there can be no doubt that they are also bound by the ordinary rules and maxims of commercial honor and personal morality. In an address which I delivered before the Ontario Dairymen's Convention at Ingersoll, in February of the present year, I felt constrained to advert to the relation existing between the dealers and producers, by a statement which appeared in the correspondence column of the Toronto *Monetary Times*, an ably conducted and influential journal, to the effect that the Dairymen of Ontario had held over a large quantity of cheese, in order

to enhance its price, until it had become "wasted and partially spoiled," and that 75,000 boxes of such cheese had been thrown on the market, to the manifest injury of the reputation of Canadian cheese, and consequent diminution of its price.

This allegation was positively contradicted by a correspondent of the *Mail*, who asserted that there had been very little complaint of overkept cheese, and that in his opinion the statement arose from the fact that a Montreal merchant or merchants, not being able to get in Canada a sufficient quantity of cheese to fill their orders, went over to the State of New York and purchased 65,000 boxes, which they shipped to England as of Canadian make; but most of it turning out to be of a low grade, they attempted to account for its inferiority by asserting that it had become deteriorated by having been too long kept. On this the Montreal *Star* commented editorially as follows:—

"We incline to the opinion that 'Dairyman,' as the writer signs himself, is correct about there being little holding over by the cheese factories, as the cheese-makers know the gain in weight by selling their product when new, instead of when dried up. Besides, the different farmers who contribute the milk to the factories on a partnership system, are not likely to agree to a serious delay in receiving their respective shares. The holding over, if any there is, chiefly rests with the commission merchants, who will know better than others whether there is any and how much truth in the story about their buying skim-milk cheese from the Americans, and selling it in England for 'Canadian.' It is to be earnestly desired that if any of our merchants engaged in such an operation, they lost so heavily by it as to prevent a repetition of it, especially of the dishonest palming off as old Canadian cheese, the poorest article of American. Such conduct is in no ordinary degree reprehensible, being a fraud upon the consumer, and a serious injury to the Canadian dairyman by detracting from the high reputation of Canadian cheese in the English market."

When I state that I have been assured by a gentleman upon whose veracity I place the most implicit reliance, and who got his information on the spot, that the story of the *Mail's* correspondent is absolutely true. I need scarcely say that I most heartily concur in the condemnation pronounced by the Editor of the *Star* upon this flagitious proceeding, with this addition that any party found guilty of such a glaring breach of public confidence should be expelled from the cheese market, like a lame duck from the Stock Exchange, or a defaulting black-leg from the betting ring. The products or our factories should not be subjected to such detraction by those who act as middle-men between the producers and the consumers, who should rather be glad to have it continue to deserve the high encomium passed upon it by Professor Arnold, who is reported to have said in the American Dairyman's Convention held at Rome, in January last, that "Canadian Cheese had met with an enlarged demand, and the reason was that this product was uniformly good, and no skimming was practiced in Canadian dairies."

If such a transaction did occur, I trust that it was an exceptional one, and that it will not be repeated; for though unscrupulous persons are to be met with in all the walks of life, and in every line of business—dirty birds who will not scruple to befoul their own nest upon very slight

temptation—I yet feel assured that the gentlemen who come across the ocean to relieve us of our surplus products in exchange for their welcome cash, are possessed of too much honor to practice such petty roguery, and of too much common sense to destroy their own hopes of profit by deliberately discrediting the very commodity in which they are investing their money.

I do not intend, nor indeed is it desirable for me to dilate upon the scientific aspect of the dairy business; that has been ably and exhaustively discussed both in our conventions and in yours; but there is one subject to which I feel it incumbent upon me to direct the attention of chemists and physiologists. I mean the possible effect of the electric state of the atmosphere upon the operations performed in the factories. This subject was suggested to my mind by the complaints made in 1875 both by dealers and consumers, of the inferior quality of the cheese made in Ontario in that season. So far as my own observation extended, I must say that those complaints were but too well founded, for I failed to find in the cheese of our district the rich, savoury, delicate flavour I had been accustomed to since the introduction of the factory system into our district. Even in Marmora and Madoc, where the cows feed upon the rich and succulent grasses of the Laurentian hills, and drink the pure and limpid water of their crystal springs and creeks, the factories did not attain the flavour and texture for which I have often commended their produce.

Now it is evident that so remarkable an effect, traceable over so extensive an area, must have a common cause; and that cause ought to be investigated so far as is possible, with a view of discovering some means of prevention or cure. Various causes were suggested: increasing dishonesty among the farmers; carelessness and remissness in the operators, and the habit of drawing the milk only once a day. For my part, I do not believe that our farmers were more dishonest in 1875 than they were in 1874 or than they are in 1876. I believe that the operators, with very few, if any, exceptions, are and were as earnest, as zealous and as attentive as they ever were or could be, and I know that the practice of drawing the milk only once a day could effect those factories alone where it was in use; those causes, therefore, could not have produced so general and widespread an effect, and we must look beyond them for another and more potent influence, and I am inclined to think that influence may be found in the electric state of the atmosphere. We know that thunder-storms affect composite liquids, such as beer and milk very powerfully, and accelerate the decomposition of organic substances in a remarkable manner; and we also know that the unobtrusive and invisible current of voltaic electricity possesses a similr decomposing power, though its action is not instantaneous, like that of the lightning-flash; and that if not identical with galvanic electricity, the electro-magnetic current is closely allied to it; and finally, the earth itself has been conclusively proved to be a large electro-magnet. It will also be recollected that the year 1875 was remarkable for the frequency and activity of its electric and magnetic disturbances.

I should like if this matter were taken up by some gentleman who has more leisure and better means and appliances for research than I have. Experiments might be made in this manner: Vats might be placed in

different positions with respect to the magnetic meridian, parallel to it, at right angles with it, and at various inclinations towards it. Some of the vats might be isolated by placing the feet upon glass supports, while others might be connected electrically with the earth by wires attached to iron pins driven far enough into the ground to come into contact with the damp subsoil, which wires at their other end might be made to dip into the vat, or be soldered to its metallic lining. Besides these many other experiments would no doubt suggest themselves to the practical philosopher, the result of which might be either to resolve the question in the negative, and thus set it at rest, or to discover some means of controlling these subtle influences, and preventing or palliating their evil effects. The question I propose is an abstruse and a complicated one, and by no means easy of solution, but we ought not to be deterred from inquiry because the investigation may be attended with difficulties; but our energies should rather be roused to encounter, and, if possible, to surmount them, and it is certain that an ample reward, both in money and fame, would await the fortunate person whose genius or whose perseverance should effect so valuable a discovery.

My task would be but partially fulfilled if I neglected to say a few words about the other staple article of dairy produce, namely, butter. Up to the close of the year 1875, although a considerable quantity of butter was exported from Canada, the export of that year alone being 15,700,000 lbs., it was all, so far as I can learn, made in private dairies, and I am not aware that a single butter factory existed in the Dominion before that time. Consequently the quality was far from uniform, and very little fine, or, as it is termed here, gilt-edged butter has been made in our dairies. Indeed so little care is exercised by some of our makers that I have tasted five different qualities of butter in one and the same basket on Belleville market, and all of them only varying from bad to worse. I do not see why the quality of Canadian butter should not be as good as that of Canadian cheese, and in some of my addresses to Dairymen's Conventions, as well as in contributions to the Press, I have advocated the establishment of butter factories as a means of improving the quality and securing the uniformity of our butter, and consequently raising its character and enhancing its price in the English market. One suggestion I have frequently offered is, that as cheese is only made during a portion of the year, the factory buildings might be utilized during the other portion, or at least a part of it, for the manufacture of butter, at a very trifling additional expense.

The question as to whether it is more advisable to invest in the making of cheese or butter depends for solution upon the comparative profit to be derived from each. If ten pounds of milk will make one pound of cheese worth ten cents net, and it takes twenty-four pounds of milk to make one pound of butter, worth twenty cents, it would seem at first sight that it would be more profitable to make cheese. But we must consider that the making of butter costs less than that of cheese; that the process is shorter and simpler, and the apparatus less costly; that there is no rennet required, and very little, if any, annatto; that the skim-milk and butter-milk are much more valuable for making pork than the whey; and that the butter is ready for market as soon as made, and does not require time to ripen, and that consequently the interest upon the capital

is saved, and perhaps we may find that butter-making is the more profitable employment of the two. It is true that I have allowed only twenty pounds of milk to the pound of butter, when it is generally found that from two to five pounds more are required, but in compensation I have rated the butter at twenty cents per pound, when good butter will bring from two to four cents, and fine from five to seven cents more, and butter made in the factories ought to be of such a quality as to command the highest run of market prices. I am also inclined to believe that by a careful selection of cattle, and the adoption of Mr. Harden's principle of deep setting at a low temperature, with such modifications as might better adapt it to a larger scale of manufacture, a much greater yield of butter in proportion to the quantity of milk employed might be obtained ; and if by the method of Mr. Jocelyn a wholesome and palatable description of cheese can be made from a mixture of skim milk and butter-milk, the combination of the two manufactures will add largely to the profits of the farmers and the prosperity of the country. On the whole then, in view of the unprecedented increase in the number of cheese factories, and of the recent course of the trade, if I were about to engage in the dairy business, I would be inclined to make butter rather than cheese.

The commercial aspect of the business has strong claims on our attention, as upon a right understanding of the laws of supply and demand depends the success or failure of all manufacturing and trading enterprizes. The English market for cheese is one which it would be difficult permanently to overstock, as its capacity has been reckoned at 800,000,000 of pounds annually, and not more than one-half of that quantity has hitherto been available from all sources. But even this large market may fluctuate from time to time, and suffer glut now and then, if the mass of the producers hold back their cheese for a time, and then pour in a large quantity all at once ; and especially is the regular course of trade liable to be interrupted by the occurrence of periods of manufacturing inactivity and commercial depression in the importing country.

It is not advisable, then, for proprietors of factories to hold back their stock with the idea of raising the price. In the face of the competition they have to encounter, they can never hope to control the market, and the attempt to do so will infallibly end in loss ; for cheese as made on this continent soon comes to perfection, and in a short additional time begins to deteriorate, and becomes almost unsaleable, just when English cheese of the same age is coming to its highest degree of excellence. So far as my information extends I have reason to believe that those persons have obtained the most satisfactory results who have sold their cheese at regular intervals, accepting the ruling price, whether high or low.—The dealers can, of course, only give such a price as will afford them a reasonable prospect of a fair commercial profit, and from the keen competition which exists among them, there is no fear of the farmer being deprived of the best price for his goods that the quality of the article will warrant, and the state of the market will allow.

Much of the time of the conventions has been occupied in the discussion and explanation of various matters of science connected with the management of milk, and the manufacture of cheese and butter, which must certainly redound much to the benefit of all parties concerned, by giving them clearer and more correct views of what ought to be done-

and what ought to be avoided, and of their own duties and responsibilities in respect to the business. Some persons, however, have not been able to see it in this light, and have asked of what use is so much scientific discussion; and of what advantage is scientific knowledge in common life and ordinary business? To this question I reply that the same methodical vigilance, the same habit of systematic inductive and deductive reasoning, tracing effects back to causes, and arranging and classifying the facts and inferences derived from close and attentive observation, which are the peculiar characteristics of the true man of science, cannot fail, when applied to ordinary circumstances, to elicit principles and maxims, a consistent adherence to which on the part of our producers and dealers will go far to prevent, or at least to modify and mitigate, the frequent vicissitudes which in too many instances prove so disastrous to those who are engaged in commercial or manufacturing enterprises, and which are more frequently occasioned by ignorance or disregard of the laws which govern the relations of producer and consumer, of buyer and seller.

It has been said, and I believe truly, that the Americans are not a cheese-eating people; that the quantity consumed is smaller in proportion to the population than in any other country. This is not difficult to account for. The abundant supply and reasonable price of butcher's meat, the quantity of game, both four-footed and winged, to be found in the forests, and on the prairies, the numerous species of fish which swarm on the coasts, and in the magnificent lakes and rivers, together with the variety and excellence of fruits and vegetables which the fertility of the soil and the geniality of the climate produce in luxuriant superabundance, have hitherto prevented the use of cheese as an ordinary article of diet; but as the population becomes denser, and the wild animals, birds, and fishes are driven out or exterminated, or their numbers so reduced as to render them mere objects of sport, it may be expected that the products of the dairy will come into more general request as an important part of the ordinary food of the people. In the meantime the way to promote their consumption is to strive to produce them of such a quality as to make them sought after as a delicacy and a luxury, and thus create a taste for their use, and increase the demand for them in the market.

I have been aware for some time that some enterprising persons, in accordance with my advice, established in the beginning of the present year, a butter factory in the Township of Hungerford, in the County of Hastings; but as I had no information as to how they were likely to succeed I did not think the fact worthy of mention. At the last moment, however, I have learned that their success has far exceeded their expectations, their butter having from the first commanded 25 cents per pound, and that they expect to get a still higher price as their brand becomes better known, the quality being such as to warrant them in entertaining such expectation.

Finally, I would repeat in this place the advice I have uniformly given to my hearers wherever my voice has been heard upon matters connected with dairy management. Farmers! practise the virtues of honesty, cleanliness, and kindness to your cattle, and send to the factories none but the best material your cows supply. Operators! continue to exert the same care, assiduity and intelligence, which have already secured so favorable a reputation for your products. Dealers! be always ready to

give a fair price for a good article, according to the state of the market, and send no poor American cheese to England as over-kept Canadian, or poor Canadian as over-kept American; or rather, send thither no poor cheese at all—refuse to buy it at any price. If the maker of such cheese has to consume it himself, he will be likely to be more honest and more painstaking in his future proceedings. By carrying out these principles in your mutual interaction you will raise the reputation of your commodity to the highest possible pitch, and materially increase at once your own respective emoluments and the wealth and prosperity of your country at large.

And now, from the stand point of a steadfast English Canadian, and a loyal subject of my Gracious and virtuous Queen, whom may Almighty God long preserve to reign over her loving subjects in every quarter of the globe, permit me to say a few words respecting the occasion which has caused so vast a concourse of persons from every region of the habitable world to assemble and meet together in this place, to join with you in celebrating the hundredth anniversary of the birth of your nation. When your forefathers, on the memorable fourth of July, 1776, declared the thirteen revolted colonies independent of the Crown and Parliament of Great Britain, it was not their own autonomy alone that they asserted, for their action vindicated the right of every community of British subjects to self-government, which right, though recognized and acknowledged, and established in theory at least within the British Islands, had never been practically allowed in the colonies. When they encountered the soldiers of Britain in the field, although neither of the contending parties was cognizant of the fact, or able to appreciate the ultimate bearing of the struggle in which they were engaged, it was emphatically Britains own battle they were waging—the battle of the British people—for they fought to maintain that great and equitable principle, the keystone of the glorious old British constitution, that no people shall be taxed unless with their own consent, expressed through their lawfully chosen representatives.

When in 1812 your Government again declared war against England, it was still the freedom of the British subject, for which your citizens fought and bled, the broad principle of the right of every individual man to choose his own nationality, and the assumption against which they contended was the right claimed by potentates and governments to hold their subjects bound to a perpetual and slavish allegiance, because they happened to be born within the territorial area over which their sway extended.

When in 1861 your people again engaged in warfare; the contest was waged between two sections of your own population, and confined within your own boundaries; and although it was begun and carried on for a time upon another issue, yet the struggle soon resolved itself again into the combat between liberty and slavery, and though the conflict was severe, and the cost both in blood and treasure heavy and exhaustive of the national resources and energies, yet the result was well worth the price paid for it; and let me, in the name of my fellow-countrymen, congratulate you, or rather let us rejoice together, that the inherited stain has been finally wiped from the fair field of your national escutcheon, that the anomaly of the highest liberty and the deepest slavery existing

together in the same community has been extinguished for ever on both sides of the line which divides our respective countries, and that we can stand up together before God and the world, and proclaim in the noble words of your first national document that before our laws "All men are free and equal."

Although our fathers declined to join yours in their struggle against British power, or to cast in their lot with them after success had crowned their efforts, preferring to stand upon the old ways, and to retain their attachment to the ancient flag, and their fealty to the ancient crown; and though we, their children, follow their example, and are resolved to maintain our connection with our parent country, and our allegiance to our beloved sovereign and her dynasty, yet we can join heart and hand with you in this commemoration, without a shade of jealousy or heart-burning, of vindictive remembrance of your past triumphs, or desire of vengeance for former injuries, and can even freely acknowledge that we owe many of the most valued privileges we enjoy to the manly stand your ancestors took against arbitrary power, and that the blessings of free thought, free speech, a free press, free religion, and freedom from unrepresented taxation, which we, equally with yourselves, possess, were in great part bought and paid for with the blood shed on their battle-fields. Do not think, therefore, that because we do not choose to join your union, but persist in remaining steadfast to our connection with our mother country. and even desire to assume still closer relations, as an integral part of that mighty empire whose possesssons girdle the earth, and to which, equally with yourselves we owe a common origin, do not think I say, that that determination and that desire spring from any hostile or unfriendly feeling towards yourselves or your institutions: on the contrary we frankly hold ont to you the right hand of fellowship, and should be glad to cultivate the most friendly relations with you, our only neighbors, in our mutual social, moral, intellectual and commercial intercourse, and to maintain with you such such a permanent interchange of good feeling and good offices as a common origin, a common language, a common religion, and a close similarity of social and political institutions ought to create between two peoples whose territories lie for so many degrees of longitude in such close proximity to each other.

If the spirits of great men departed are permitted to observe the events that occur in this transitory sphere, which they have left to enjoy the delights of a happy eternity, and the soul of William Penn is cognizant of what is now transpiring in the city of his living love, how must the spirit of the grand old philanthropist rejoice to behold the triumph of those principles of brotherly love and universal good-will, for the sake of which he left the home of his fathers, and the amenities of civilized life, to encounter the storms of the ocean and the perils of the wilderness, and to erect a new home in the society of the savage, beneath the gigantic shadows of the primeval forest.

That simple home, by the blessing of Divine Providence upon the principles under which it was founded, has expanded into this noble city, replete with all the comforts and luxuries of life, adorned with the triumphs of art and the achievements of genius, affording the most refined delights of social intercourse, and welcoming to its embrace the devotee of art, the student of literature, and the cultivator of science. A city

whose wide extent can accommodate, and whose warm hospitality can welcome the representative men of the human race, who have been attracted hither by the grand display of the productions of human art, human skill, human knowledge, human industry, and human ingenuity, so largely accumulated within its walls, and so worthily committed to its guardianship.

The occurrence of this celebration necessarily recalls the recollection of that unhappy time when our fathers and yours met each other in hostile array, and fought with the embittered animosity which attends family quarrels, and becomes fiercer as the relationship is closer. Let us, however, be thankful that the hundred years which have elapsed have healed the wounds reciprocally inflicted in the strife; and let us hope that ere another century shall have glided into the bosom of eternity, by the exercise of mutual consideration, mutual concession, mutual goodwill, and mutual good offices on both sides, the very scars of these wounds may be effaced, and nothing remain of the past but the remembrance of our common origin; and that in the near, as well as in the remote future, wherever an American and a Briton shall meet, either in an individual or an official capacity, they may feel and act towards each other as friends and brothers.

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No. 3,	for about	2	gallons of	Cream	.....	$ 6 00	No. 7,	for about 18 gallons of cream	..... $12 00
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The Factory sizes (Nos. 8 & 9) are found to be exactly what is needed in large Daries, or Factories, where power is used. They have the unqualified commendation of every one who has used them.

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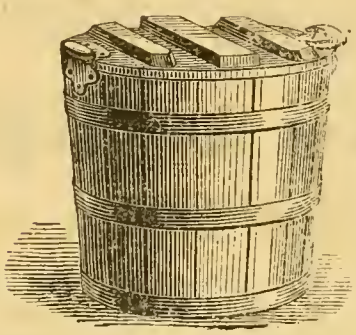

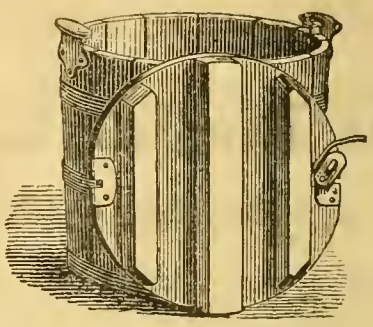

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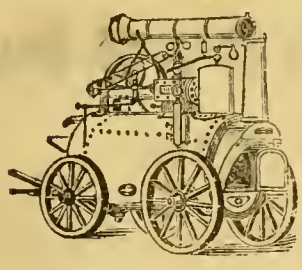

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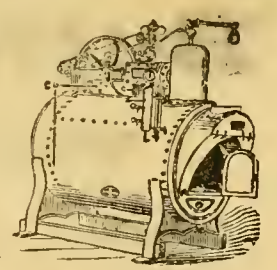

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